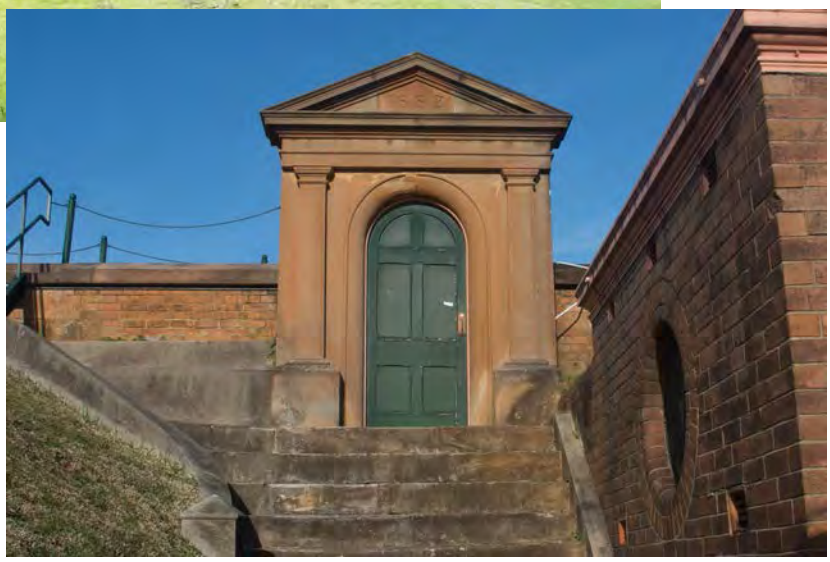
NEWCASTLE'S FIRST WATER SUPPLY — THE "WALKA" SCHEME

NOMINATION FOR ENGINEERING HERITAGE RECOGNITION



PREPARED FOR
ENGINEERING HERITAGE NEWCASTLE

Cover photographs of Walka pumping station and portico of Newcastle No. 1 Reservoir by Bill Jordan

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INTRODUCTION

This proposal has been prepared by Bill Jordan, on behalf of Engineering Heritage Newcastle.

The water supply scheme for Newcastle and surrounding towns was initiated in 1876 with the appointment of a Commission to investigate the needs of the area, was kicked along by the appointment of the eminent English Civil Engineer William Clark in 1877, constructed by the NSW Department of Public Works and the first stage completed in 1886.

The construction of the scheme by the State government led directly to the formation of the Hunter District Water Board to allow management of the scheme when completed. It also gave insight into the political machinations of the time when it is seen that the construction of the two major reservoirs was completed well before the pumping station at Walka and even before the pipes to convey the water from Walka to the reservoirs had even been ordered from England.

The scheme appears to have included the first filtration plant built in Australia for the whole of the supply. Unlike most others at the time it was entirely piped, with no open channels, and the reservoirs were roofed, ensuring a supply that was clean from the start and could not be contaminated along the route.

The major elements of the scheme are remarkably intact including the pumphouse, but sadly not the pumps, the filter beds and tanks, the holding lagoon and the major distribution reservoirs.

Conservation Management Plans have been completed for various elements of the scheme but this nomination is the first document to bring them all together. Its preparation has excited the (now) different owners and is leading to further research by many people. Many records were uncovered as part of the nomination and more are likely to be found in the time to come.

The scheme as designed and constructed is considered to be of national significance and it achieved a number of "firsts" in the history of Australian water supply.

HERITAGE MARKER NOMINATION FORM

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of work: Hunter River District Water Supply, commonly known as the Walka Water Supply Scheme

The above-named work is nominated for recognition under the EHA Heritage Recognition Program. Research to date indicates that aspects of the scheme are of national significance.

Location, including address and map grid reference if a fixed work:

AMG references, all Zone 56

FACILITY	EASTING	NORTHING	COMMENTS
Walka Water Works	364 404	6 379 514	Pumping Station near Hunter River
Buttai Reservoir	365 366	6 370 958	High level from which all gravitated (in service)
Newcastle No. 1 Reservoir	385 720	6 355 769	Main distribution reservoir (opened for inspection)
"The Obelisk" reservoir	385 830	6 355 605	Small reservoir for higher parts of town (filled in)
Shepherds Hill Reservoir	385 748	6 355 125	Smaller reservoir for the few highest properties

Owner (name & address):

Various remaining elements of the scheme are now in different ownership. The three reservoirs are still in the ownership of the Hunter Water Corporation (formerly the Hunter District Water Board); the Walka facility is administered by a Trust and Maitland City Council.

The owners and lessee have been advised of this nomination and the relevant letter of agreement for the ceremony at Newcastle No. 1 Reservoir is attached. The Walka Trust is not presently operating and its functions are being handled by the NSW Crown Lands office; this organisation has agreed verbally, with enthusiasm, but recent management changes have delayed the official letter. We have been assured that it will be forthcoming for a subsequent ceremony at that location. (Appendix A).

Access to site:

No. 1 Reservoir is now open to the public on a ballot basis, with the entrance being readily seen from the street. Walka Water Works is open as a recreation area, although the buildings are presently closed. The public has continuous and ready access to the top of the now filled in Obelisk reservoir and the Shepherds Hill reservoir.

Nominating Body: Engineering Heritage Newcastle

for Chair of Engineering Heritage Newcastle

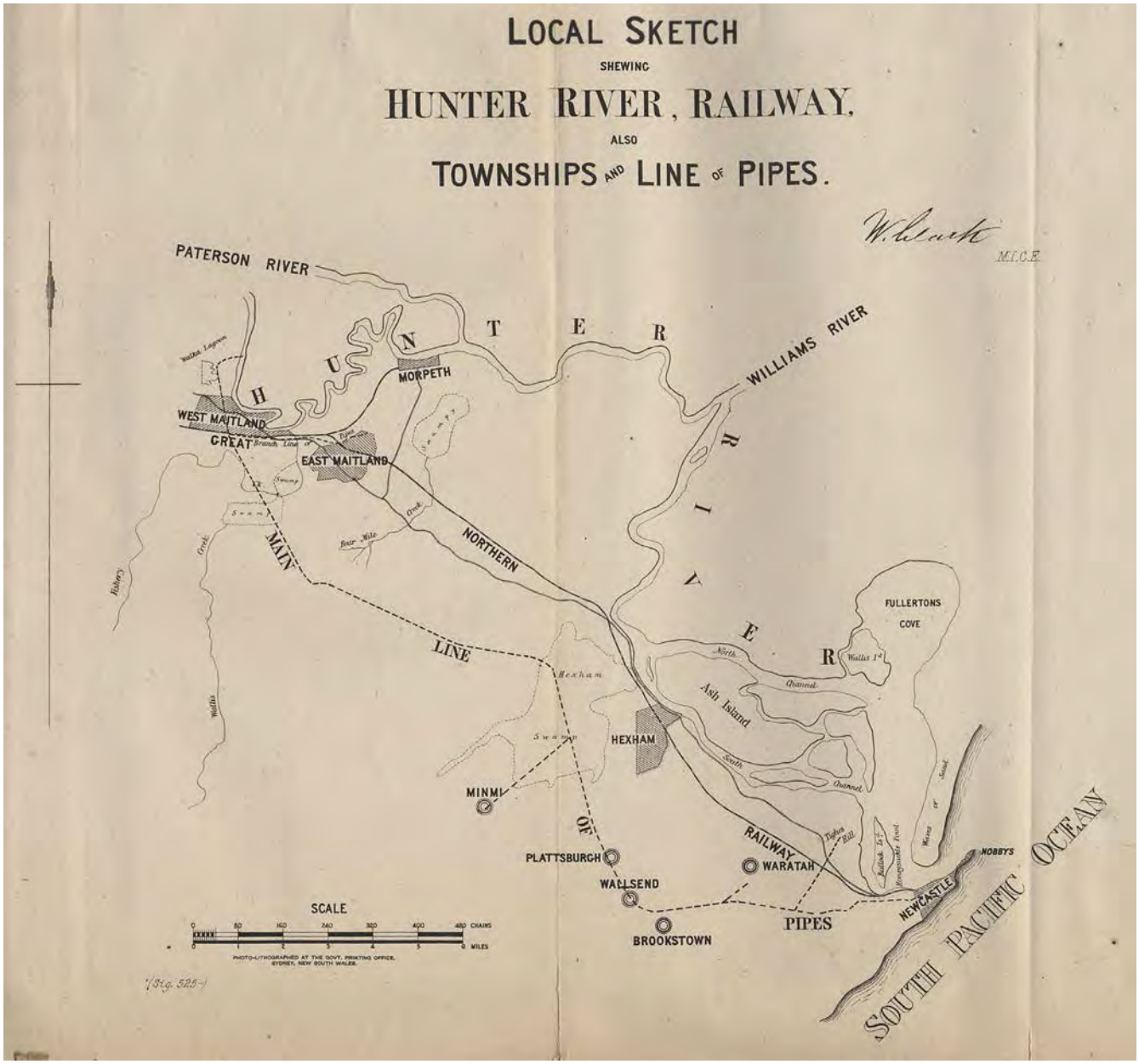

Figure 1: Original plan showing the scheme from William Clark's report to the NSW Government in 1877.

HERITAGE ASSESSMENT

BASIC DATA

Item Name: Walka Water Supply Scheme

Other/Former Names: Hunter River District Water Supply; Newcastle and Maitland Water Supply

Location (grid reference if possible): see location map and nomination form

Suburb/Nearest Town: From west of Maitland at Oakhampton to central Newcastle with branches to towns along the way

State: New South Wales

Local Govt. Area: Various

Owners: Hunter Water Corporation; Walka Water Works Trust

Current Use: Parts still in use (Buttai reservoir); others remaining open to public access under various conditions.

Former Use (if any): Nil

Designer: .William Clark (overall scheme) and NSW Public Works Department

Maker/Builder: NSW Public Works Department

Year Started: 1880 **Year Completed:** 1885 **Years of operation:** 1885 to 1945 (standby only from 1925)

Physical Description: Pumping stations, water treatment plant, pipelines, reservoirs

Physical Condition: Reservoirs at source and some destinations largely intact; main pumping station (Walka) buildings reservoir, tanks and filter structures remain; remnants of pipelines remain.

Modifications and Dates: see heritage listings for Walka end; additional pipeline added at eastern end in early 1900s;

Historical Notes: (see separate details)

Heritage Listings: Source pumping station and treatment plant at Walka listed on NSW State Heritage Register; reservoirs at Buttai and Newcastle on Hunter Water Corporation s.190 register

ASSESSMENT OF SIGNIFICANCE

(This assessment is additional to that already found on the NSW State Heritage Register entries which are appended)

Historical Phase: The scheme as a whole led to tensions between the various municipal authorities over the costs and responsibilities of supply of water over such a large area. The formation of the Hunter District Water Board stemmed directly from the situation.

Historical Individuals or Association: GA Lloyd, MLA, was instrumental in having the NSW Government proceed; William Clark M.Inst.C.E. was almost wholly responsible for the design.

Creative or Technical Achievement: The scheme in design and execution utilised the latest technology available, including chemical and biological analyses of source water and the design and building of filters to treat the water. The flexible pumping system which allowed the one set of pumps to be used for all pumping at the source (suction from the river, pumping to and from the storage lagoon and the various tanks, and pumping onwards to the high level reservoir) was leading technology for the time.

Research Potential: history of filtering in Australian water supply design is yet to be adequately researched.

Social: The water supply for Newcastle and towns in the lower Hunter Valley was a key to great improvements in public health and the development of the city and towns as we now know them.

Rarity: 19th century water supply schemes exist in a number of places in Australia, but only one other is known which possibly had water treatment facilities to the extent of those at Walka, and not at the source and for the whole system; many others had settlement tanks or ponds, but none of this period are known with filtration tanks with filter media and the ability to clean that media.

Representativeness: The scheme for supply, filtration, storage and delivery was in line with best world's best practice at the time.

Integrity/Intactness: Sufficient of the works remain to allow interpretation

References: (see history)

Statement of Significance: The Hunter River District Water Supply Scheme is an excellent example of the progress made in the late 19th century to provide safe and sustainable water supplies to metropolitan populations. The scheme as a whole was thoroughly researched to ensure that quality and quantity of supply would be available for the communities of the lower Hnter Valley. It used the best technology available at the time, transferred from Britain, and was the first in Australia to use comprehensive treatment at the source. It was:

- the centerpiece of the most important advance in public health in the history of the Hunter Valley, improving health and cleanliness of the population and their urban environment;
- the most comprehensive set of water treatment features surviving in NSW, documenting the growth of the demand for water;
- a finely executed polychrome brick structure, demonstrating the importance of the aesthetic treatment from late 19th century infrastructure[1].

It is a testament to the work of English Civil Engineer, William Clark M.Inst.C.E.

Assessed Significance (whether National, State or Local): The scheme as constructed is of National significance as the first adoption of large scale system filtration known in Australia and as one of the largest and most comprehensive 19th century water supply schemes in the country.

Image(s) with caption(s): (throughout this document)

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1 partly taken from Maitland City Council Walka Water Works Interpretation Masterplan, 2015

SOURCES

This history is taken from various sources, as referenced in footnotes. In particular, thanks are given to Dr MacLaren North, of FUTURE*PAST* Heritage Consulting Pty Ltd, for permission to quote extensively from "Newcastle Reservoirs Site Corner of Tyrrell and Brown Sts, The Hill, Conservation Management Plan" prepared for Hunter Water Corporation.

Information on William Clark, including a copy of his original membership certificate, was kindly provided by the librarian of the Institution of Civil Engineers, London.

THE BEGINNINGS

The first Europeans arrived in Newcastle following the discovery of coal by Lieutenant John Shortland in 1797, and fresh supplies of water were found to be both close at hand and seemingly abundant at the site of settlement. Initially, the natural water supply, which caught on the high ground overlooking the river's mouth and drained through to emerge as springs on the foreshore of the river, was tapped by sinking wells[2]. Whilst these public wells were sufficient in meeting the domestic needs of Newcastle in the early years, rainwater collected from rooftops and stored in tanks increasingly became adopted as the principal source of supply for residents[3]

Newcastle City Council established a water committee in 1866, and in 1875 the committee sought the advice of the Sydney City Council Engineer, Francis Bell, to investigate the resources of the region. The Council and Committee were unable to reach a consensus on Bell's recommendations, however, and subsequently the State Parliament appointed a commission to investigate the matter. In 1877 William Clark, an eminent English hydraulic engineer who had been working in India[4], was commissioned by the Colonial government, and in October 1880 authorisation was given for construction to begin on the Hunter River District Water Supply, which came to be known as the Walka Water Supply Scheme.

Newcastle's quest for a permanent water supply began in the 1860s when water shortages due to drought were becoming virtually an annual occurrence[5]. Public concern over the lack of reliable water supply was fed not only by public health and domestic hygiene concerns, but also a growing awareness of the vulnerability of Newcastle's urban fabric to fire[6].

Over the decade following Newcastle Council's establishment of the water committee, Council considered a number of different schemes for the supply of water to the town. Sites considered included the Big Redhead Reserve to the south, the Hunter River and a disused pit on the Australian Agricultural (AA) Company's land to the south of the settlement[7]. The Newcastle Council's Water Committee sought the advice of Francis Bell, the Sydney City Council Engineer, to investigate Newcastle's water resources in 1875. However the Council and Committee were unable to reach a consensus on Bell's recommendations and they were later rejected[8]. Consequently, GA Lloyd, Newcastle's representative in the State Legislative Assembly addressed the parliament regarding the critical water supply position of the town and Maitland, and requested the appointment of a commission to investigate the problem[9].

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2 J. W. Armstrong (1967) Pipelines and People. The History of the Hunter District Water Board, The Hunter District Water Board, Newcastle, p. 3

3 C. Lloyd, P. Troy, and S. Schreiner (1992) For the Public Health. The Hunter District Water Board 1892 – 1992, Longman Cheshire Pty Ltd, Melbourne, p. 4

4 Biographical details for William Clark appear later and in an appendix

5 A. Larcombe (1976) The Stabilisation of Local Government in New South Wales 1858-1906, Sydney University Press, Sydney, p. 246

6 Lloyd et. al., op. cit., p. 9

7 Ibid., p. 11

8 Ibid., p. 17

9 Armstrong, op. cit., p. 13

THE HUNTER RIVER DISTRICT WATER SUPPLY SCHEME

GA Lloyd's representations were successful and a commission was appointed in 1876. In 1877 William Clark, an eminent English hydraulic engineer who had just completed investigations into a new source of supply for the Sydney Metropolis, was commissioned by the Colonial Government to plan a comprehensive water supply scheme for the Newcastle area, including East and West Maitland, Morpeth and the local mining townships[10]. Concluding that the Hunter River above Maitland was the only secure source, Clark proposed that water be pumped from the Hunter River above Maitland, at Dickson's Falls (near Bolwarra), to a nearby tank where it would be filtered into a clear water tank, pumped to Buttai Hill and transmitted via gravitation to reservoirs for reticulation to the various townships[11]. Clark also provided, under his Scheme for "Supply of water for the towns of Maitland, Morpeth, Newcastle, and the mining townships"[12], for the establishment of a storage lagoon at Oakhampton (at the main pumping station), where the tanks and filtering ponds would also be located, into which water from the river could be pumped and left to settle when the river water was particularly muddy[13]. The main reservoir in Newcastle, now known as Newcastle Reservoir No. 1, was the receiving reservoir for distribution of water around Newcastle. In addition, two smaller reservoirs were built at a higher level beside the "Obelisk" and even higher at Shepherds Hill, the highest point above the city. Clark pointed out in his report that these reservoirs could only be filled at night, when demand was low, and that it would probably eventually require a pump to feed them[14].

The main pumping station was sited beside an existing lagoon, known as Walka Lagoon. This was enhanced with a dam wall for initial storage and gave its name to the scheme as a whole in much of the subsequent history.

Consequently, representatives from the ten municipalities of the Hunter District adopted the scheme unanimously, and the next few years were filled with discussion, delegations and deputations concerned with the implementation of the scheme. Finally, in October 1880 authorization was given by the NSW Colonial Government for construction to begin[15]. Possibly due to political pressure, work started on construction of the Newcastle and Buttai reservoirs, although the there was no means of pumping water to them. Both reservoirs are dated 1882.

The Public Works Department and private contractors undertook the detailed design and much of the early construction work, and by 1885 most phases of the long overdue water supply scheme were completed, including the trunk pipelines. Despite not all sections of the pumping plant being finished, in the summer of 1885, due to prolonged heat and water shortages, the government agreed to deliver a potable supply of water to Newcastle and townships from the Walka Waterworks via a temporary pumping station[16]. Consequently, on 31st December 1885 people gathered at the Newcastle reservoir in Tyrrell Street to watch water from the Hunter River trickle into the reservoir for the first time[17]. This initial pumping was only temporary however, with work on the scheme officially completed in December 1886.

Over the next few years, reticulation expanded to more and more townships, reaching Mayfield in 1887 and East Maitland and Morpeth by 1888. This expansion of the reticulation networks as well as the capacity of existing systems was to continue progressively from this point onwards in the history of the Hunter District Water Board.

In 1880, along with authorization for the construction of the Walka Waterworks, came the passage of the Country Towns Water and Sewerage Act, which enabled the Public Works Department (PWD) to construct water supply and sewerage systems for regional towns and cities[18]. This Act however, brought particular problems for Newcastle and the region as the intention of the government, under the Act, was to use the PWD to construct works, sending the bill to the relevant council. In the Hunter region however, individual supplies of water for townships were impractical. As such, the region needed to build an integrated system, which meant that responsibility

10 Larcombe, op. cit., p. 205

11 Lloyd, op. cit., p. 19

12 Report to the Government of New South Wales by W. Clark, Member of Institute [sic] of Civil Engineers, Charles Potter, Acting Government Printer, 1877. The full report is appended.

13 Armstrong, op. cit., p. 17

14 Clark's report, 1877.

15 G. Jones (1967) The Movement for Newcastle's First Water Supply 1875-1885, The Council of the City of Newcastle, Newcastle, p. 9

16 Lloyd, op. cit., p. 24

17 Armstrong, op. cit., p. 27

18 Ibid., p. 23

for the Walka Water Supply Scheme was to be divided between thirteen municipalities. There was no provision made in the Act for Newcastle's quasi-metropolitan status, however, and consequently, whilst the NSW Government sold the water from the reservoirs to the thirteen municipal councils individually, nobody was able to determine a formula by which repayments of the capital costs and interest on the scheme could be achieved[19]. This, combined with a growing climate of public dissatisfaction with the Walka Waterworks and in particular the price of water, methods of billing, water quality and allocation of responsibility, saw the government decide to establish a board to administer Newcastle's water scheme[20]. As such, in 1892 legislation was passed vesting responsibility for the repayment of capital in one instrumentality, and the second water supply authority in NSW was formed; the Hunter District Water Supply and Sewerage Board[21].

On 1 July 1892 the Hunter District Water Supply and Sewerage Board ("the Board") was incorporated[22]. Initially staffed by 20 individuals transferred from the Public Work Department, the Board not only inherited a viable waterworks and distributive system, but also some drains and some sewer lines to an ocean outfall, all previously developed by the Newcastle Borough Council[23]. Sewering of Newcastle and surrounding townships, however, was dangerously neglected, drainage was largely ineffective in many areas, and most townships in the region continued to suffer without a permanent water supply.

As the Board's early years passed, it realised that the Hunter River would not meet the region's requirements. Demand for water doubled between the Board's incorporation in 1892 and 1900, and anxiety increased with the realisation that significantly greater demands would be made due to the proposal to construct a modern sewerage system[24]. Furthermore, whilst the Hunter River water met the fundamental requirements of potability, it was hard water, and as such was unsuitable for several domestic and commercial uses[25]. Consequently, it was estimated that demand from the Walka Waterworks was about 38 per cent lower than it would have been if the water had not been hard[26]. Household tanks and wells made up the difference, capturing rainfall to use for domestic laundry and cleaning purposes, whilst industrial users built their own reservoirs, sank wells or tapped stormwater drains for low-grade water[27]. Whilst hardness did not compel the Board to investigate alternative water sources, it did exacerbate community resentment[28].

It was not these problems, but the great droughts of 1902 and 1906 that finally convinced the Board to investigate alternative sources of water supply[29]. The Board were forced to implement its first restrictions on the use of water in 1902 after flow in the Hunter River was substantially reduced by drought. As a consequence of this, J.B. Henson, the Board's Chief Engineer, was instructed to assess the water resources of the Hunter Valley. Henson's recommendations began a long process of analysis and consultation. In 1908, J.B. Henson produced a major report to that effect, which led to the investigations of the potential damming of the Goulburn or Chichester Rivers[30]. With his broad conception of exploiting the water resources of the ranges to the north of the Hunter received favourably by the Public Works Department, part of the catchment was gazetted for that purpose by the Public Works Department at the urging of the Board[31]. In the years following the presentation of Henson's report the engineers and surveyors of the Public Works Department investigated the feasibility of the proposals. The Chichester Dam scheme was ultimately favoured and the Public Works Department started construction in 1916.

During this time, the threat of water shortages, raised by the droughts of 1902 and 1906 and the rapidly growing population, also saw the enforced temporary reduction of the amount of water used for irrigation upstream of

19 Lloyd, op. cit., p. 22

20 Ibid., p. 28

21 Armstrong, op. cit., p. 33

22 Ibid., p. 40

23 Lloyd, op. cit., p. 7

24 Armstrong, op. cit., p. 70

25 Lloyd, op. cit., p. 119

26 Ibid.

27 Ibid., p. 121

28 Ibid.

29 Lloyd. op cit., p. 121

30 Lloyd, op. cit., p. 123

31 Ibid., p. 127

Walka Waterworks[32]. In addition, when the single delivery pipe between Walka and Newcastle failed to deliver water as fast as it was being used over the summer of 1905-06, causing Newcastle and other reservoirs to be occasionally exhausted, the Board began strong efforts to induce the Government to duplicate the pipe[33]. In 1906 the Parliamentary Standing Committee on Public Works approved the laying of a 20-inch pipeline from Sandgate Road, Wallsend, to Buttai Reservoir[34]. Construction of this second pipeline was undertaken by the Public Works Department in 1907 and 1908[35]. By 1910 heavier water demands of the region called for the three pumping engines at Walka Waterworks to be worked continuously at times, bringing fears of the serious consequences that would come if one of the engines were to break down[36]. As such, among other things, the Public Works Department was urged by the Board to provide a new bulk storage reservoir at Rutherford[37]. In 1912, the Board celebrated its twentieth year of operations. The population supplied with water and the quantity of water supplied, had climbed to five times the 1892 figures, with the length of pipes in use multiplied three times[38].

Meanwhile, despite the NSW State Government approving construction of Chichester Dam in 1916, the war situation retarded progress, and the bulk of work on the gravitation main, the most costly phase of the project, was not done until the 1920s[39]. Despite the tight water situation, it was largely believed the Chichester Scheme was very much an initiative of the Board, and not a response to a popular agitation or a programme imposed by the government[40]. Widely publicised in the press, reports were mostly supportive, interpreting the proposal as a radical change of approach[41]. Despite this widespread support for the scheme however, the prospect of higher water rates remained an obstacle for the community[42].

WILLIAM CLARK

William Clark had a distinguished career in the mid 19th century as a civil and mechanical engineer. His obituary in the Journal of the Institution of Civil Engineers is worth quoting in full.

> MR WILLIAM CLARK was born at Colchester, on the 17th of March, 1821. His education was obtained principally at King's College, London, which he entered in 1842, and where he was so distinguished for industry and diligence, that, on the termination of his three years' course, he was made an Associate of the College. Soon afterwards he became a pupil of, and subsequently an assistant to, Mr Eirkinshaw, M.Inst.C.E., under whom, first as assistant and afterwards as resident engineer, he was employed for a period of three or four years on the works of the York and North Midland railway system. In 1850 he was connected with the late Sir Goldsworthy Gurney, who at that time had charge of the warming and ventilating of the Houses of Parliament. In 1851 he entered into partnership with Mr. A. W. Makinson, M.Inst.C.E., the firm devoting special attention to the warming and ventilating of public buildings. He was shortly afterwards offered and accepted the appointment of surveyor to the Local Board of Health of Eingston-upon-Hull, and devised a complete system of drainage for that town, the works of which were commenced by him. In 1854 he entered the service of the East Indian Railway Company as a second-class engineer. After acting for upwards of a year as resident engineer on a portion of the East Indian railway, forming part of the district under Mr Sibley, M.Inst.C.E., he became the secretary, and subsequently the engineer, to the Municipality of Calcutta, which was considering what could be done to improve the sanitary condition of that city, then in a very unsatisfactory condition. Mr Clark devoted himself with characteristic zeal and ability to this work, and after a comparatively short interval, spent in making the necessary surveys and inquiries into the local circumstances, was enabled to propose a complete scheme for the drainage of Calcutta. In preparing this he found the great advantage of his previous acquaintance with drainage work, especially as required for low-lying towns, built on the alluvial soil, on the shores of navigable rivers. His scheme for the drainage of Calcutta was much in advance of the views of the Municipal Council, who

32 G. Karskens (1986) Dungog Shire Heritage Study. Thematic History, Perumal, Wrathall and Murphy Pty Ltd, Environmental Planners, in association with Cameron McNamara, Dungog, p. 185

33 Armstrong, op. cit., p. 71

34 Ibid., p. 72

35 Ibid., p. 73

36 Armstrong, op. cit., p 7

37 Ibid.

38 Ibid., p. 76

39 Ibid., p. 100

40 Lloyd, op. cit., p. 126

41 Lloyd, op. cit., p. 126

42 Ibid., p. 127

were not only incredulous as to the improvement in public health which might be expected from such a thorough drainage as Mr Clark proposed, but were also startled by the suggestion to lay out a sum of money much larger than had previously been contemplated for such improvements. The scheme was, therefore, warmly opposed: in Calcutta he had to live down prejudice and misrepresentation. He felt that he was capable of doing the city justice if only its citizens would believe in him, and see for themselves what well directed energy could achieve. But the President of the Municipality regarded him with jealousy; several of the native Justices of the Peace opposed a stolid resistance; and even newspapers ceased not for years to speak of him with scurrility. Ultimately, owing to the steadfastness and ability with which Mr Clark supported his views, the Council were won over to allow a portion of the plan, devised as an experiment, to be carried into effect. Under Mr Clark, as engineer, the drainage was successfully carried out, withouthe aid or assistance of any contractor, native labour being employed departmentally. This was the first instance in which the improved drainage system of England had been initiated and adopted in t.he populous cities of India. The success of this work, and its marked influence on the state of the public health in Calcutta,were most complete.

In addition to the drainage, Mr Clark devised a complete system of waterworks for Calcutta, comprising three large pumping stations with their filter beds and settling tanks, all of which were executed under his charge and personal supervision. Mr Clark continued to act as engineer-in-chief to the Municipality of Calcutta until the commencement of 1874, when he returned to England and entered into partnership with Mr W. F. Batho, M.Inst.C.E. In the same year Mr Clark received the appointment of consulting engineer to the Oudh and Rohilkund Railway Company. In December, 1874, Mr Clark visited Madras, where he remained for four months planning a system of drainage for that city: he submitted to Government an able report thereon, but the work was not carried out for want of funds.

In 1876, at the recommendation of Mr G. R. Stephenson, Past- President, Inst. C.E., Mr Clark was selected by the Colonial Office and appointed by the Government of New South Wales, to advise and report upon the water supply and drainage of Sydney. During a residence of two years in the Australasian colonies, he prepared several schemes of a like description, embracing the towns of Port Adelaide, Newcastle, Bathurst, Goulbourn [sic], Orange, Maitland, Brisbane and subsequently Wellington and Christchurch in New Zealand. Mr Clark's plan for the drainage of Christchurch was commenced in 1879, the sewage pumping machinery having been designed and erected under his supervision, and dispatched with a considerable quantity of pipes. Among Mr Clark's inventions may be mentioned his "tied brick arch," of which fine constructive examples exist in Calcutta and other places in India; he was also joint patentee with Mr W. F. Batho of the now well-known steam road-roller. Among his schemes may be mentioned the proposal for reclaiming the saltwater lakes in the neighbourhood of Calcutta. Having suffered for about six months from a liver affection, the germs of which were doubtless laid in the country to which he had devoted the best of his life, Mr Clark died at Surbiton, on the 22nd of January, 1880. Mr Clark was elected a Member of the Institution on the 2nd of February, 1864: he was also a Member of the Institution of Mechanical Engineers. By sterling integrity and honourable conduct as an engineer, by a generous and kindly disposition in private life, together with his manly influence and example, Mr Clark will long be favourably remembered.

Further biographical information is appended. It is notable that the "tied brick arches" mentioned were also used in the Newcastle scheme on the two large covered reservoirs.

THE SCHEME AS BUILT

From Walka, the water was pumped to Buttai Hill at an elevation of 287 ft (87.5 m) above MHWS at Newcastle Harbour; the reservoir held 1 000 000 gallons (4.55 Mℓ) and was covered to prevent contamination of the treated water.

From Buttai the water gravitated to reservoirs in Newcastle and eventually its suburbs; a branch from the rising main was later built to supply East Maitland. In Newcastle itself there were three reservoirs, including the main one of 524 000 gallons (2.38 Mℓ) in Brown Street, near the corner of Tyrrell Street, one of 137 000 gallons (622 kℓ) at The Obelisk to supply homes on high levels and a smaller one on Shepherd's Hill of 20 000 gallons (91 kℓ) to serve a few elevated properties in the vicinity[43]. All reservoirs were roofed.

At its inception, only the reservoirs at Buttai and Newcastle were built with others added as needs and public pressure demanded

Walka Waterworks at the peak of its operations (with seven filter beds) and a side elevation of the Pumping Station.

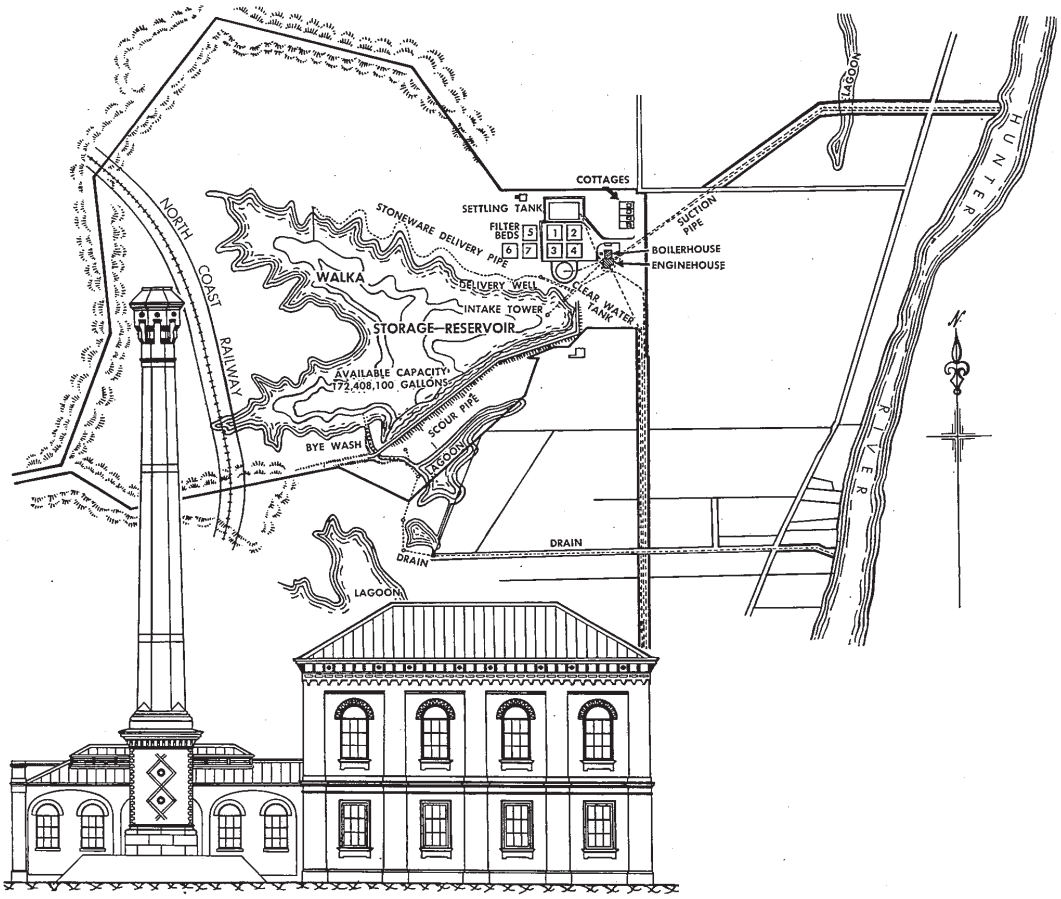

Figure 2: As seen in the caption copied with this drawing, the treatment plant was basically as designed by William Clark, but with more filter beds. Clark's drawing (Plan No. 6 in appended report) has the settling tank, three filter beds and the clear water tank. Filter beds 1 to 4 were part of the original Public Works design of the 1880s; filters 5, 6 and 7 appear to have been added in the early 1900s.

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43 J.W. Armstrong op. cit, p.52 for data in this section

Figure 3: The site of Walka Waterworks as seen today (Google Earth, May 2015). The Hunter River is approximately 600 m to the east (right of the photograph). Compare with figure 1.
At the bottom left is the reservoir, or lagoon, used for primary settling when river water was particularly dirty; the rectangular tank near the top is the settling tank to which water was pumped either directly from the river or from the lagoon, depending on its turbidity.
The remains of seven filter beds can be seen from which water gravitated to the circular clean water tank. It was pumped from the clean water tank to the distribution system.
Using a complex system of valves, the three engines performed all required pumping operations, including the suction through a tunnel from the river (aerial photograph, Google Earth).

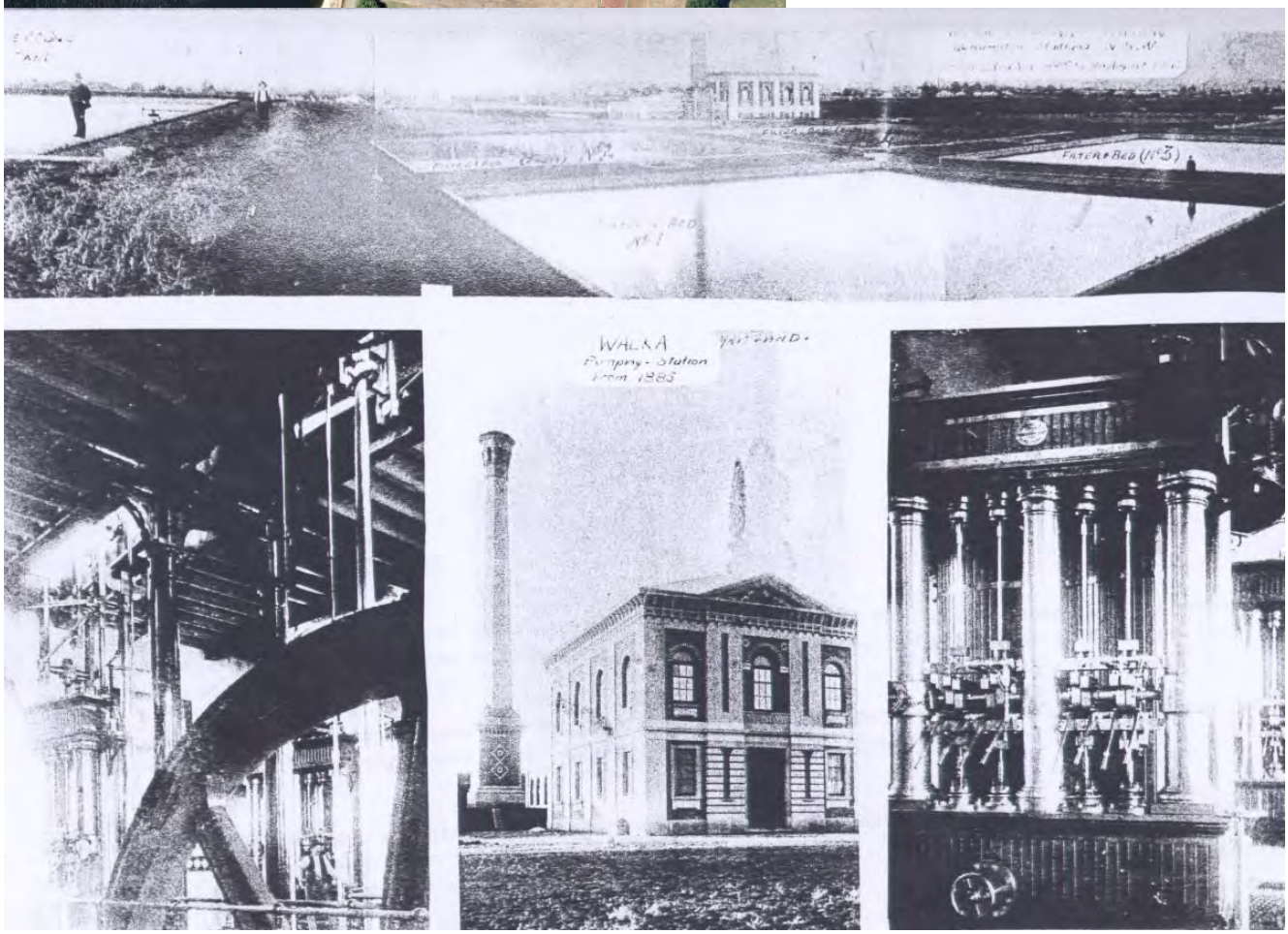


Figure 4: A photo compilation showing the Walka pump house and some of the plant in 1885. The top photo is from the west with the settling tank on the left and the four filter beds below it; the circular clean water tank can just be made out below the filter beds. Some idea of the size of the Watt beam engines can be gleaned from photos in the lower panel (from Walka Waterworks Trust collection).

WHAT REMAINS

YEARS OF OPERATION

As noted in the history, the water supply scheme was superseded by the Chichester Dam scheme and Walka Water Works was put into mothballs in 1925. The pumping station was run rarely after then and it was finally closed in 1945.

After the the Second World War, New South Wales experienced severe shortages of electrical power and, while plans were being made through the newly established Electricity Commission of NSW for the establishment of new base-load power stations and a high voltage transmission network, temporary small power stations were established in many centres to meet the needs: one of these was at Walka and another at the Honeysuckle Point Railway Workshops in Newcastle (Historic Engineering Marker, 1996).

The three massive James Watt beam engines were scrapped when the power station was built: as recorded on a panel at Walka, the scrap value was £2500. The coal-fired power station was in a new, separate building (now demolished) and there was no need other than a short term financial gain for the engines to be scrapped.

The Buttai Reservoir is intact and still in use; the Newcastle No. 1 Reservoir is intact and has now been opened for public admission on a regular basis by ballot; remains of the high-level Obelisk reservoir can still be seen although it was filled in following an accident caused by a gas explosion in 1984. The Shepherds Hill Reservoir remains intact, but unused.

WALKA PUMPING STATION

The original pumps were driven by three James Watt & Co. beam engines, chosen instead of higher speed directly connected steam engines due to their known reliability. Each of the engines had a 36 ton flywheel[44].

The site of the "Walka Waterworks" is under the control of a trust set up in the 1980s for public recreation. Originally the pump house was set up as a museum, but that has now been closed due to safety concerns and staffing difficulties. There are various pieces of historical Hunter Water plant on display in the grounds near the pump house.

Figure 5: The settling tank, as seen today, looking west with the filter beds to the left of the photograph (photograph Bill Jordan).

Of most interest, apart from the buildings and masonry chimney, are the various tanks and filters which can still be seen and interpreted. These are illustrated in figures 3 to 8 above and following.

44 ibid, p. 49

Figure 6: Some of the filter beds contain remnants of the filter medium (photograph Bill Jordan).

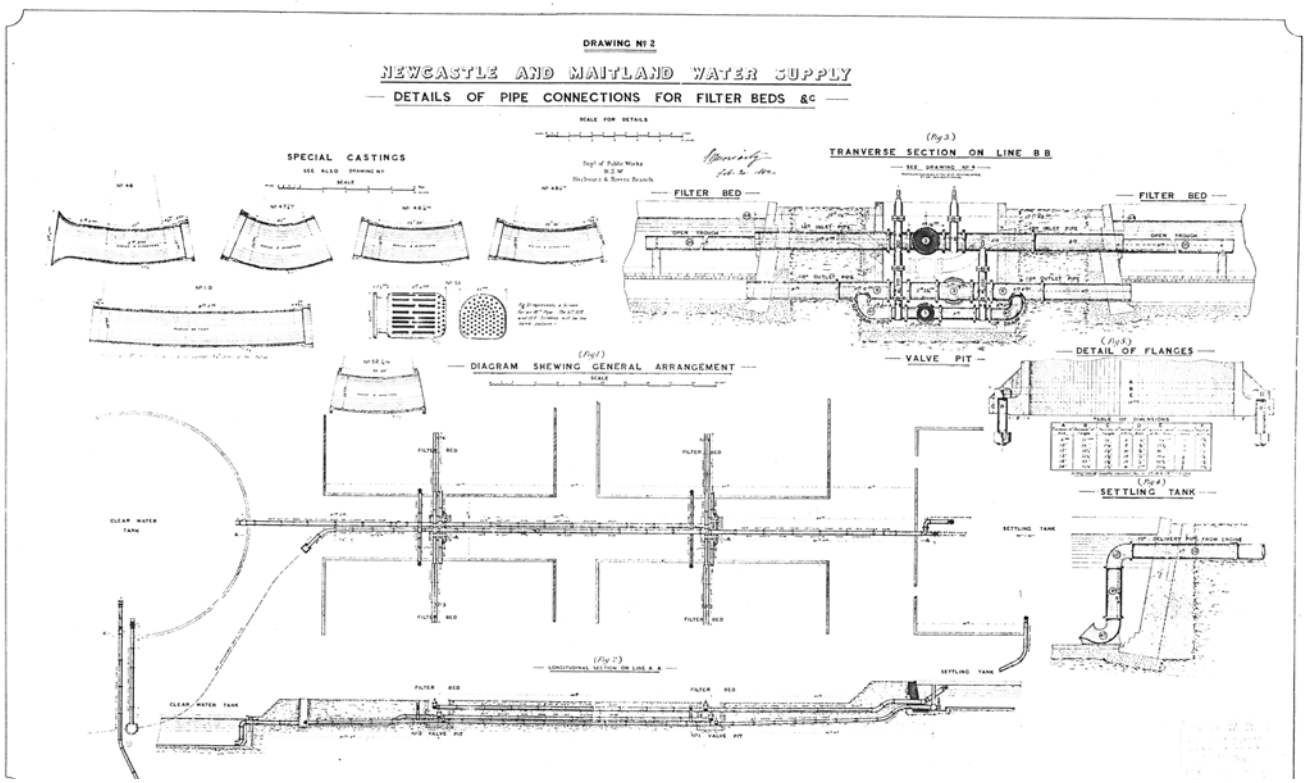


Figure 7: One of the few original drawings to have been found from the Walka end of the scheme shows the pipe layout from the settling tank, via the filter beds, to the clear water tank. It is interesting to note that this drawing, signed by the renowned NSW PWD engineer Edward Moriarty on February 20th, 1882, refers to the "Newcastle and Maitland Water Supply" whereas earlier drawings are entitled "Hunter River District Water Supply"; the Newcastle No. 1 Reservoir is headed simply "Newcastle water supply" (Maitland City Council collection).

Figure 8: The clear water tank is the most intact part of the treatment plant (photograph Bill Jordan).

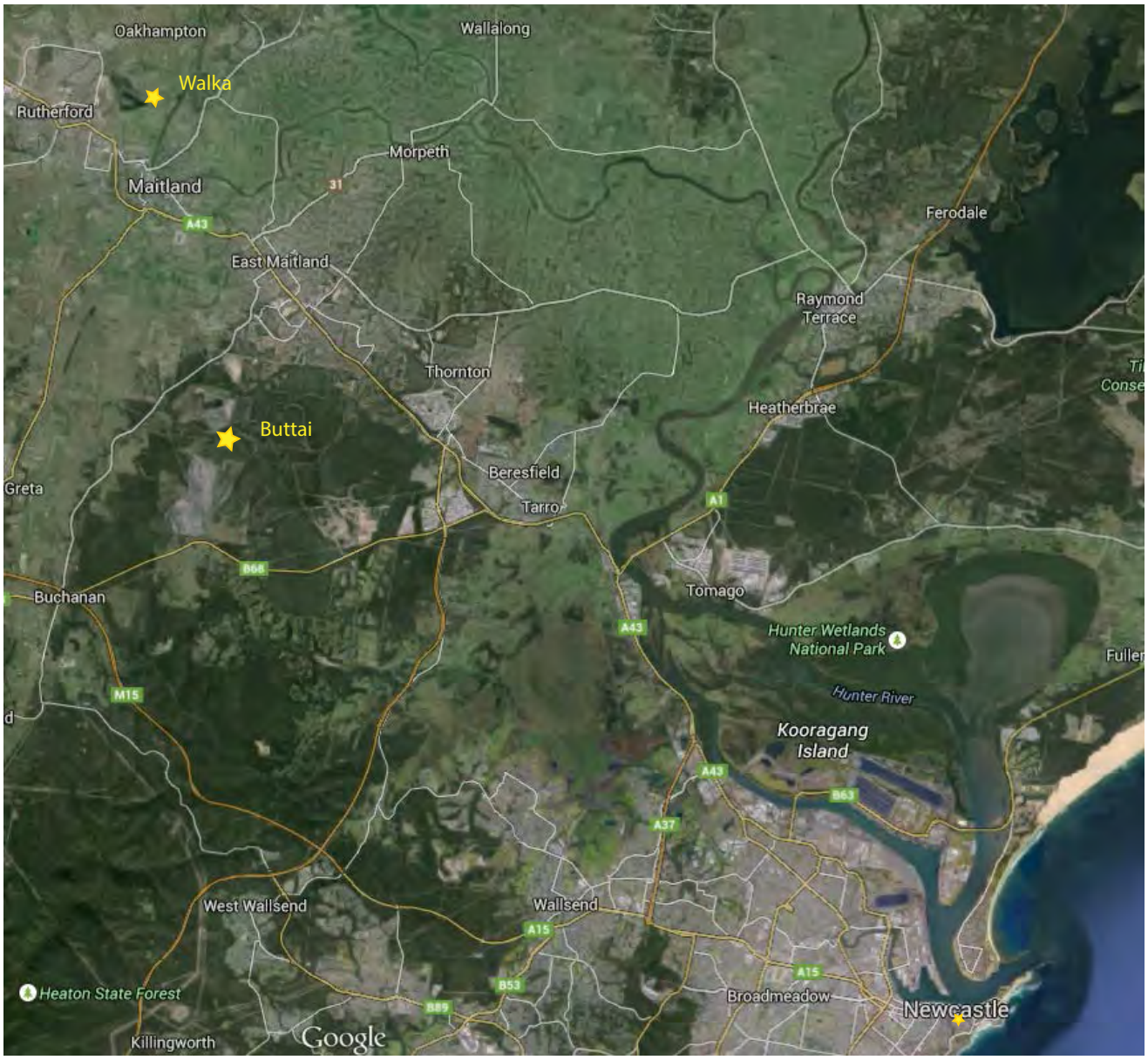


Figure 9: This aerial photo mosaic shows the arrangement of the essential elements of the distribution system as first constructed. Water was pumped from Walka to Buttai from where it gravitated to the Newcastle reservoirs. Additional branches were added both before and after Buttai as the scheme was developed. (Google Maps)

BUTTAI RESERVOIR

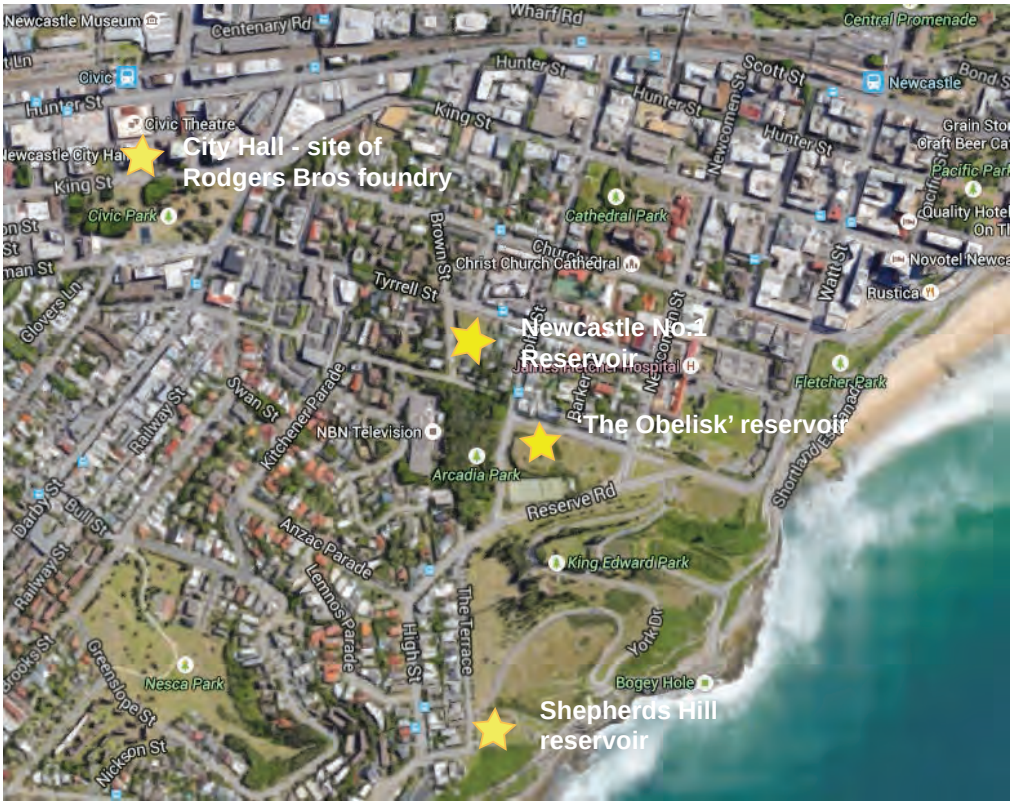
Buttai Reservoir is the high level distribution reservoir of 1 million gallons (4.55 Mℓ) which is a larger version of the Newcastle No. 1 Reservoir, described in detail below: it is still in use.

Figure 10: Buttai No.1 Reservoir (1882) is still in use and surrounded by the later No.2 Reservoir. It is the same form of construction as the Newcastle Reservoir, but the barrel vaults have not been covered with earth and can still be easily seen from on top. (Hunter Water Corporation records)

NEWCASTLE RESERVOIRS

There are three of the original reservoirs still intact to varying degrees on the hill above the Newcastle CBD. The positions of the reservoirs are shown in figure 11.

Figure 11: Location of the three original reservoirs above Newcastle CBD. All are now out of service and The Obelisk reservoir has been filled in following roof collapse from an explosion in 1984. (Google Maps)



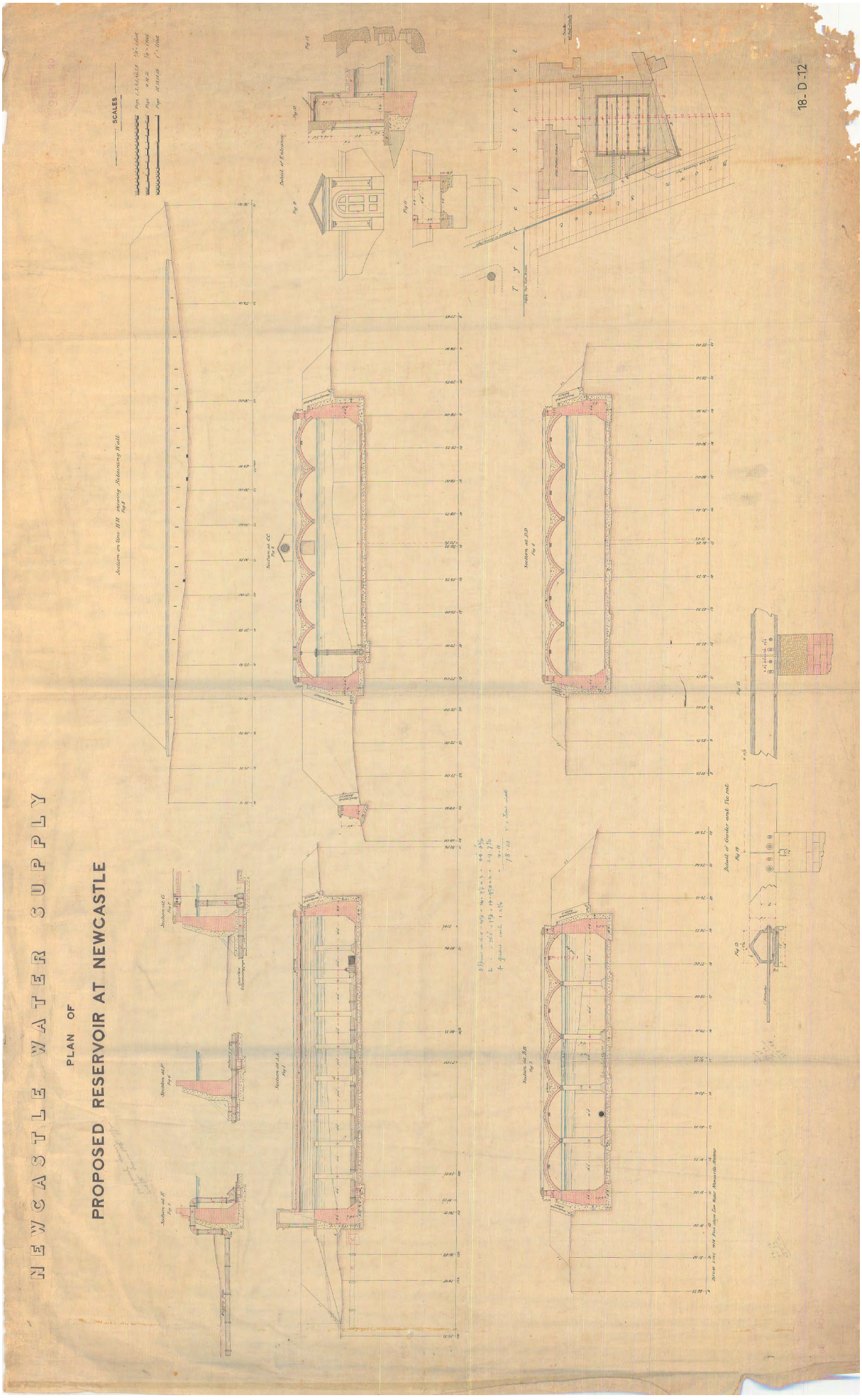


Figure 12: A later tracing, which has also been tinted, of the Newcastle No. 1 Reservoir. Details of significant elements are shown following. (Hunter Water Corporation records)

All the reservoirs at Newcastle were of brick construction with vaulted brick roofs. The two smaller ones are/were circular with a centre dome and an annular vault supported on a cast iron circular beam and the external wall. The main one, Reservoir No.1, is rectangular and its features are illustrated on the cover of this document and below.

The Newcastle No. 1 Reservoir has been the focus of considerable interest in the last two years. In sequence:

- Hunter Water Corporation, the incorporated successor to the Hunter District Water Board, realised the heritage significance of parts of its infrastructure and commissioned a Conservation Management Plan for the reservoir;
- the heritage significance of the reservoir was established at State level, at least;
- the author of this nomination was commissioned to undertake a condition assessment of the reservoir structure;
- after considerable investigation and analysis, it was determined that the reservoir structure was safe for opening to the public and for activities to take place on its roof;
- following preparation of a Statement of Heritage Impact, also by the current author, minor modifications were made at the entrance to the reservoir to enable a staircase to be constructed which allowed safe public access;
- publicity was generated by the Hunter Water Corporation public affairs team which created strong public interest and a scheme was developed with the cooperation of local media to allow public access on a monthly basis, with visitors gaining entry by ballot, for which there have been thousands of applicants.

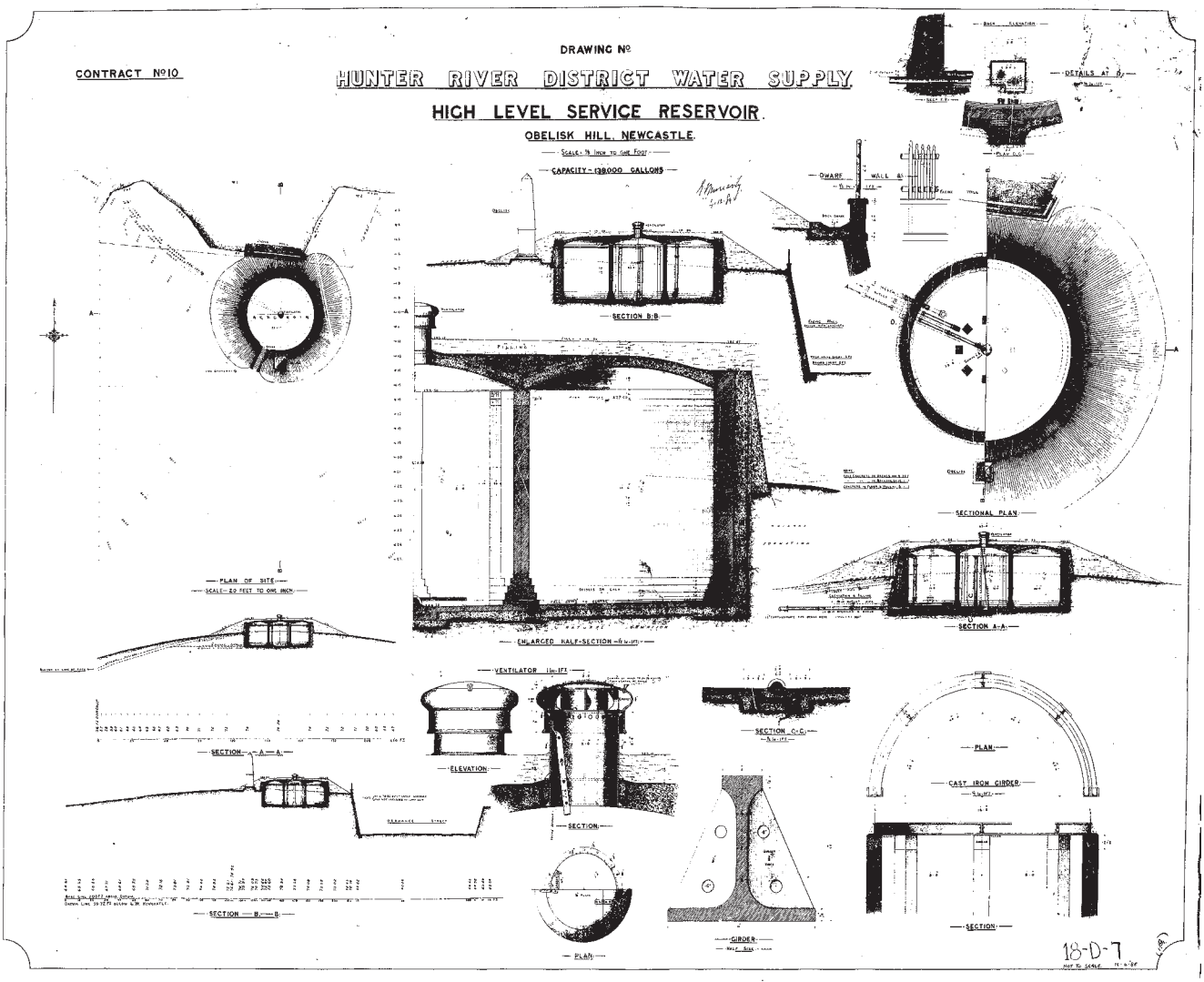


Figure 13 The smaller service reservoir beside the obelisk in the suburb now known as The Hill. The roof of this reservoir collapsed following a gas explosion in 1984 and was filled with earth. (Hunter Water Corporation records)

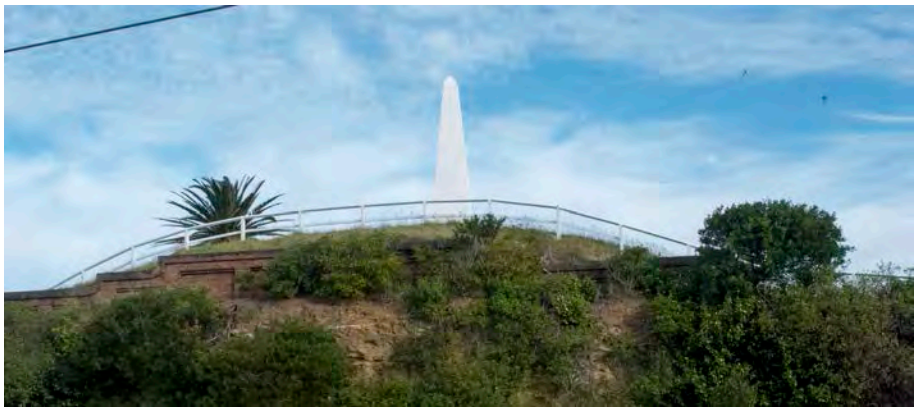


Figure 14: The retaining wall on the northern side the Obelisk reservoir can still be seen. The obelisk was originally built in 1850 to replace a windmill used as a marker by ships entering the Port of Newcastle. (Photo Bill Jordan)

Details of the engineering analysis leading to the public opening will be presented in a paper to be given at the Engineering Heritage Australia biennial conference being held in Newcastle in December 2015.

Figure 15: Inside Newcastle No. 1 Reservoir, completed in 1882. Buttai Reservoir, which is of similar construction but larger, is still in service.
The "tied brick arches", developed by William Clark, allowed the barrel vaults to progress at different rates without as much risk of collapse.
The cast iron beams were cast in Newcastle and are shown in detail below. (Photo Bill Jordan)

Figure 16: A detail from the original drawing showing the pentagonal cast iron beams which were shaped and sized to enable the barrel vaults to be sprung from the sloping top flange.
The beams were cast at the nearby Rodgers Bros foundry in Newcastle and tests showed that the cast iron properties equated with material being cast in England in the same period. Hunter Water Corporation)

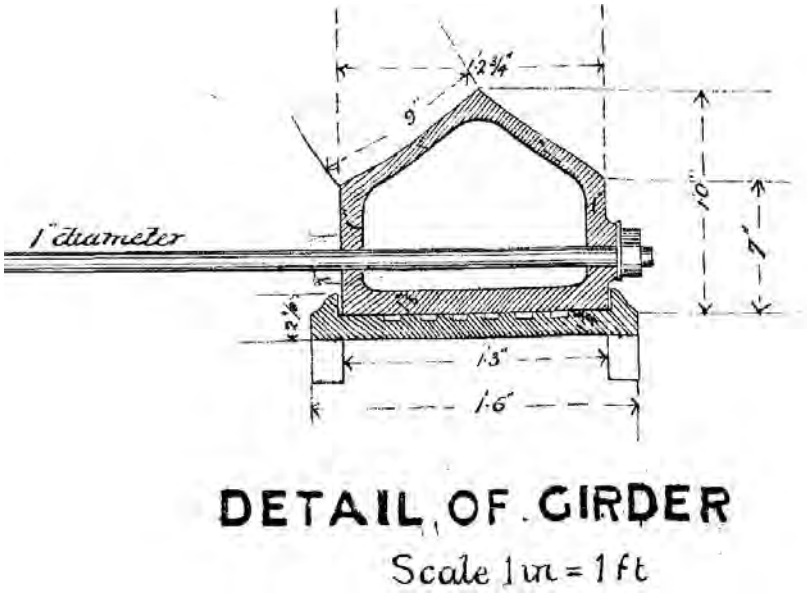


Figure 17: A late 19th century panorama, looking west, of what is today Civic Park, with St Andrew's Church on the left and the Rodgers Bros foundry arrowed. The AA Co. railway to the Hamilton pits can also be seen on the left. The Rodgers Bros site is now occupied by Newcastle City Hall. (Newcastle Local History collection)

Figure 18: The scene of figure 17 from a similar viewpoint in 2015. The tower of St Andrew's Church can still be seen. The City Hall clock tower, which is covered in scaffolding, is located where the Rodgers Bros foundry is seen in the historical photograph. (Photo, Bill Jordan)

OTHER PARTS OF AUSTRALIA

Schemes

Water supply schemes were implemented in various other parts of Australia from the mid 19th century. Initially the schemes were built to satisfy demands which could not be met by wells and tanks, such as the Yan Yean scheme supplying Melbourne (from 1853) and the Coliban Scheme for Bendigo (started in 1866 and operational from 1877).

New South Wales

At the period in question, Sydney's water supply was still being obtained from the Botany Swamps with a pumping station taking it to the Crown Street Reservoir. No filtration or treatment is recorded. Parramatta had the 1850s' Parramatta Dam (NEL 1997) but, again, no treatment is recorded.

Queensland

Queensland schemes are well documented, particularly by the late Professor Ray Whitmore in his book "Queensland's Early Waterworks"[45] in which, referring to the 1870s, he states:

> Nineteenth century waterworks were normally relatively simple systems and neither filtration nor purification of the water was usually attempted in Australia.

No filtration is recorded in that State for the period concerned.

South Australia

No records of early filtration exist for Adelaide or other South Australian settlements.

Tasmania

Tasmania had water supply schemes for Hobart (various from 1831) and Launceston (1836 & 1857), but neither is recorded as being filtered[46].

Victoria

The Coliban Scheme for Bendigo is recorded as having a sand bed filter on Reservoir No. 7[47] and later a "more complex water treatment plant at Crusoe Reservoir (1873), but no filtration for the supply as a whole at the source. It is conjectured that the filtration was to overcome contamination from the long open aqueducts supplying the reservoirs and reflected the relative purity of the source.

Western Australia

The first public water supply for Perth (and Fremantle) was inaugurated in 1891. Its first filter was installed in 1912[48]

Conclusion

The Walka Water Supply Scheme was the first in Australia to have treatment for the whole of the supply. To complement this treatment, all delivery was by pipeline, with no open channels, and all reservoirs were roofed to prevent contamination of the treated water.

The scheme is a primary example of the value of technology transfer in the 19th century. It not only transferred technology from "the old country" as was so much similar transfer, but built on William Clark's extensive Indian experience.

There is no doubt that it served as an example of best practice for other parts of Australia.

45 Whitmore, R.L., Queensland's Early Waterworks", Department of Natural Resources, Queensland, 1997, p. 3

46 Peter Spratt AM FIEAust CPEng, personal communication, May 2015.

47 Coliban Water, Joseph Brady's Coliban System of Water Works, an Historical Guide, March 2014

48 Engineering Heritage WA, Nomination for heritage recognition of Perth's First Public Water Supply, October 2012

INTERPRETATION STRATEGY

Strategy for interpretation of the Engineering Heritage Works is laid out in EHA's "Guide to the Engineering Heritage Recognition Program" (2012).

Figure 19: Entrance to Newcastle Reservoir No. 1 in Brown Street. A number of panels and plaques are already on the wall. The panel on the left, erected recently, is shown below.

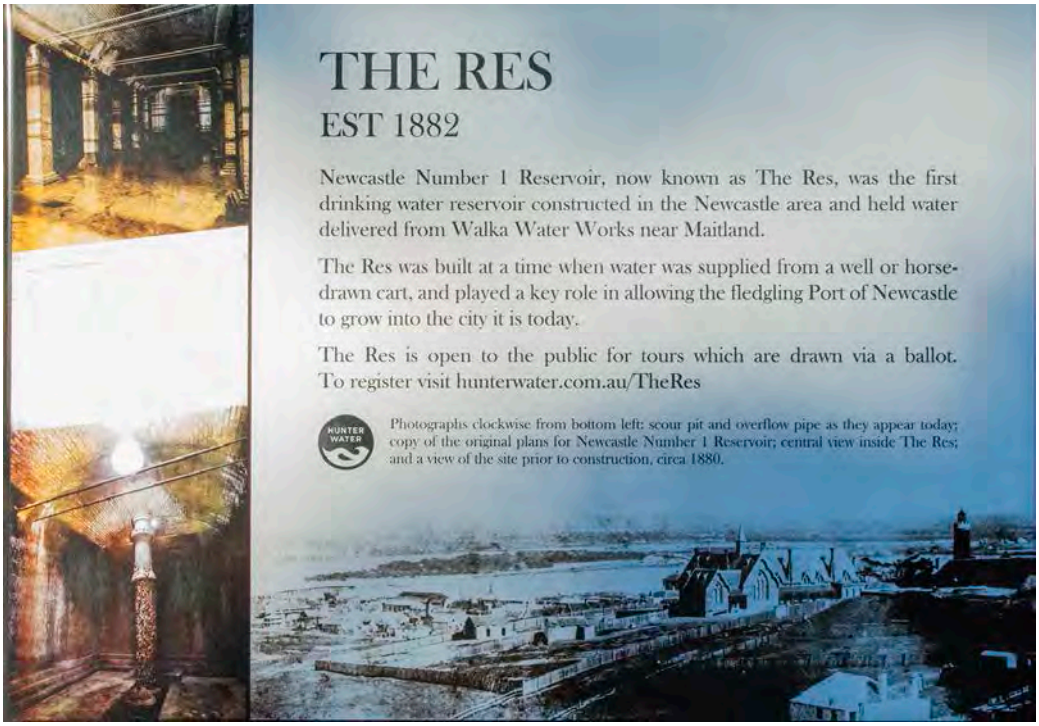


Figure 20: This recently erected panel is some indication of the excitement felt in Hunter Water Corporation following their realisation of the significance of the heritage asset they have to display in Newcastle. The title, "The Res", is a product of the public relations exercise and has never been used before.

In an overall sense, interpretation will be by: marking the works with an appropriate level of Heritage Marker; a public ceremony to unveil that Marker; and an interpretation panel which summarises the heritage and significant features of the works for the public.

The interpretation strategy will be directed towards bringing the disparate parts of the original scheme together once again and showing the owners and the public how important it is in the development of safe water supplies in NSW and Australia as a whole.

This will be achieved firstly by publicity that will be generated around the heritage recognition ceremony to be carried out during the December 2015 Engineering Heritage Conference. The present owner of much of the works, Hunter Water Corporation is being very cooperative and is looking forward to the proceedings. The de-facto trustee of the Walka site, Maitland City Council is also looking forward to the proceedings.

A panel will be unveiled at Newcastle Reservoir No. 1. A second panel will be unveiled at the Walka site at an appropriate time in the future. The Newcastle ceremony is likely to generate significant publicity and there will be the opportunity of including the adjacent school, Newcastle East Public School, in the ceremony. This school is claimed to be the oldest continuously open school in Australia and will celebrate its bicentenary in 2016.

STRUCTURE OF INTERPRETATION PANELS FOR TWO SITES

It is proposed that interpretation panels be erected at Newcastle No. 1 Reservoir and at Walka Waterworks.

Both panels are intended to be 1200 mm x 600 mm. The one in Newcastle would be best mounted on the external wall, in Brown Street, where it can be best seen by passing pedestrians.

The panel at Walka can be mounted on a stand outside the pumphouse where other interpretative signs are mounted.

DESIGN PROCESS FOR THE PANEL CONTENT

The panel will be designed, with possible slight variations for the two sites, to enable it to be reproduced at a high resolution in either vitreous enamel (preferred) or other medium. It will be done by Engineering Heritage Newcastle with assistance from Hunter Water Corporation which has a graphic arts facility.

CONTENT OF THE INTERPRETATION

TITLE

The title will reflect both the historical names and the present name.

LAYOUT

A background graphic relating to the scheme as a whole will be used. The original layout of William Clark will be used where possible and other original drawings may be used if the different aspect ration needs to be accommodated.

PRIMARY THEME (WATER AND HEALTH IN 19TH CENTURY)

Much has been written on the problems caused by contaminated water in the 19th century. William Clark's report to the NSW parliament contains some staggering statistics on the prevalence of water-borne diseases in Newcastle which prompted the actions taken. These statistics will be incorporated.

SECONDARY THEME (HISTORY)

The history will incorporate the three phases of the political process, the appointment of and design by William Clark, the detailed design and construction by the NSW Public Works Department and its prominent engineer Edward Moriarty and, finally, the circumstances related to the scheme which led to the formation of the Hunter District Water Board.

TERTIARY THEME (PIONEERING WHOLE-OF-SCHEME TREATMENT)

The primary engineering significance of the scheme is its scope and sophistication in the context of 19th century water supplies. The full treatment of the water at the source and its conveyance totally by pipeline into covered reservoirs was a "first" for Australia. Whilst some treatment facilities had been constructed in Victoria at distribution reservoirs, none others came anywhere near the sophistication of Walka:

- in concept, both inert and biological contamination were considered in the design;
- in final design comprehensive source filtration was implemented and with the ability to clean the filter media;
- particular care was taken in design the whole scheme to protect the supply from contamination between source and delivery.

Many major cities in Australia still do not have complete protection of the supply from external contamination from source to kitchen tap.

GRAPHICS

MAP

The plan shown in figure 1 will be used as the basis. This will be overlaid or supplemented as required to enable understanding by readers.

IMAGES

Images such as those in the body of this report and in the appended collection of additional images will be used for the best impact.

REFERENCES

The most significant references cited above plus others which are relevant are listed here.

Clark, William, *Report to The Government of New South Wales on a Supply of Water for the Towns of Maitland, Morpeth, Newcastle, and The Mining Townships,* Charles Potter, Acting Government Printer, 1877.

Armstrong, John W., *Pipelines and People. The History of the Hunter District Water Board*, The Hunter District Water Board, Newcastle, 1967.

Jones, Glennie, *The Movement for Newcastle's First Water Supply 1875-1885*, The Council of the City of Newcastle, Newcastle, 1967.

Tresev Pty Ltd, *Conservation Plan. Walka Waterworks*, 1986. Includes contributions by archaeologist Don Godden & Associates and historian Dr John Turner.

Futurepast Heritage Consulting Pty Ltd, *Newcastle Reservoirs Site Conservation Management Plan,* 2011

Futurepast Heritage Consulting Pty Ltd, *Buttai Reservoir Conservation Management Plan*

APPENDIX A

Letters of approval from owners

Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657 (T)
(02) 4979 9468 (F)
enquiries@hunterwater.com.au
hunterwater.com.au

28 May 2015

Rod Caldwell
Engineers Australia
122 Parry Street
Newcastle West, NSW, 2302

Dear Mr Caldwell,

RE: ENGINEERING HERITAGE RECOGNITION OF NEWCASTLE'S FIRST WATER SUPPLY SCHEME

Thank you for your recent letter seeking formal approval for Engineering Heritage Newcastle to propose the Walka Water Supply Scheme be recognised for engineering excellence.

Further to the conversation you had with my colleague Nick Kaiser on 27 May 2015, I am providing approval for the proposed recognition of the Walka Water Supply Scheme, including the commemoration panel, marker and ceremony at the Newcastle Reservoir Number 1 (The Res) site in early December 2015.

This approval is on the basis that Engineering Heritage Newcastle will allow Hunter Water final approval on the commemorative panel and the details of the ceremony to be held at The Res.

I am also providing in principle support for Hunter Water to either partially or completely fund the commemoration panel, based on a cost estimate of $2,000 and subject to further discussion.

Nick Kaiser will be your best contact for arranging the details of this recognition. He can be contacted at nick.kaiser@hunterwater.com.au or (02) 4979 9669.

JEREMY BATH
Chief Customer Service Officer

APPENDIX B

Report to NSW Parliament by William Clark

1876-7

NEW SOUTH WALES.

SUPPLY OF WATER FOR THE TOWNS OF MAITLAND, MORPETH, NEWCASTLE, AND THE MINING TOWNSHIPS.

REPORT

TO THE

GOVERNMENT OF NEW SOUTH WALES

ON

SUPPLY OF WATER FOR THE TOWNS OF MAITLAND, MORPETH, NEWCASTLE, AND THE MINING TOWNSHIPS:

BY

W. CLARK,
MEMBER INSTITUTE OF CIVIL ENGINEERS.

Presented to Parliament by Command.

SYDNEY: CHARLES POTTER, ACTING GOVERNMENT PRINTER.

1877.

1876–7.

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BY

W. CLARK,
MEMBER INSTITUTE OF CIVIL ENGINEERS.

Presented to Parliament by Command.

SYDNEY: CHARLES POTTER, ACTING GOVERNMENT PRINTER.

1877.

[4s.] 525—A

REPORT to the Government of New South Wales on a Supply of Water for the Towns of Maitland, Morpeth, Newcastle, and the Mining Townships.

To the Honorable the Colonial Secretary,
New South Wales.

Sir,

I have the honor to report that, in conformity with instructions contained in Mr. Halloran's letter of the 25th June, I proceeded to Newcastle and Maitland, with a view to advising the Government on the subject of a Water Supply to those towns, together with the Mining Townships hereinafter mentioned.

On the 14th July, (having in the meantime visited Bathurst), a Progress Report was submitted, and on the 16th I had the honor of an interview with the Honorable Sir H. Parkes, and then received instructions to advise the Government generally, both as to the quantity of water which should be supplied, and also as to the works necessary for obtaining it in the cheapest manner, consistent with efficiency, from the source which might commend itself to my judgment as the most reliable and permanent.

When I returned to Newcastle on the 17th July, I received Mr. Surveyor Fuller's Report on the Lagoon and Watershed near to Lake Macquarie, alluded to in my Progress Report. Mr. Fuller's Report is given in the Appendix, page 11.

In consideration of the small catchment area, the low elevation of the lagoon above the sea, and the nature of the country, entirely underlaid by coal, I did not consider it necessary to make further inquiry into this scheme.

I therefore examined the country between Newcastle and West Maitland, with a view to obtain some other source of supply, but no nearer source than the river Hunter could be found.

The tidal influence does not extend beyond West Maitland, and at a point called " Bolwarra," or Dickson's Falls, it has never, even during periods of drought, been brackish, though with the exception of extensive waterholes along the gravelly bed in extreme droughts it has apparently ceased to flow.

During this inquiry the district called " Richmond Vale," where there is a shallow lagoon some 60 or 70 acres in extent, and a catchment area five or six square miles, was brought to my notice.

This lagoon however is equally distant from Newcastle with Bolwarra Falls, the water would require to be pumped, and as it is also underlaid by coal, there would be the same chance of pollution from pit drainage water in the event of workings being established in the future.

Perceiving no special advantage in this locality, it was also abandoned as a source of supply.

The river Hunter, which receives all the other sources and has a very large drainage area above Bolwarra Falls, appears to be the nearest source for a permanent supply, for even in periods of extreme drought there is doubtless a current in the gravelly bed.

Before finally deciding the point on the river Hunter whence the water could be taken, there being no records of the flow and condition of the river during periods of drought, I made especial inquiries on this subject. On the occasion of my first visit to Maitland, on the 29th June, I saw the river very low; there had been no rain for a period of some months capable of adding materially to its flow; there was then, however, considerably more water passing down than would be required for the proposed supply.

I subsequently addressed a letter to the Town Council of Maitland, requesting their assistance in obtaining evidence of persons who had resided in the district for many years; this letter and the replies received thereto are given in the Appendix, pages 11 and 12.

Samples of the water were also obtained from three different points in the river at and above Bolwarra, for analysis by Professor Liversidge, the result of which proves that the water will require careful filtration; and I have considered it desirable to obtain his approval of the proposed mode of purification.

The analysis and correspondence on this subject are given in the Appendix, page 13. It is desirable that the small cemetery belonging to the Wesleyan community situated on the banks of the river near the proposed pumping station should be closed.

I have no doubt of the sufficiency of the source, neither is there, I think, any cause for apprehension as to the permanent freshness of the water; the saline influence seldom extends to the point where the level of a river is unaffected by the tide, and the chain of deep waterholes in the gravelly bed here insures, I consider, a constant supply of fresh water at all seasons, and that it would be impossible to find another point so favourable, all things considered, as that at Bolwarra.

The adoption of this source would necessitate the formation of a large reservoir, which could be filled when water is abundant, and drawn upon when the river is muddy.

Acting as a settling tank for the water, this would also be a storage reservoir, whence water could be obtained in times of severe drought.

It would also be necessary to provide filters for purifying the water.

On a full consideration of all these points, I have decided to obtain the water from the river Hunter, at the place above mentioned, and propose to construct works capable of supplying the under-mentioned places and populations:—

West Maitland	5,381
East Maitland	3,000
Morpeth	1,368
Minmi	1,200
Plattsburg	2,300
Wallsend	2,500
Brooks Town	300
Lambton	2,000
Waratah	1,850
Burwood	1,240
Hamilton	1,070
Wickham	750
Newcastle	9,350
Sundry small villages	2,760
Total population ...	35,069

At present the water for domestic purposes is partly obtained from roof cisterns,—these, however, are chiefly confined to the better class of houses—partly from wells, and partly by a purchased supply at 9d. to 1s. per hogshead for water of doubtful purity; while in the mining townships the creek water is frequently drunk, and there is a considerable amount of fever in consequence.

In one place only, Newcastle, have I been able to obtain any information as to mortality. The Mayor, E. Wallace, Esq., has furnished me with the following information:—

In 1871 the deaths were	285
1872 ,, ...	294
1873 ,, ...	345
1874 ,, ...	439
1875 ,, ...	516
1876 ,, ...	628

The average percentage of zymotic disease for the last five years is 20·6; in 1876 it was 32·1.

This

This is all the information I have been able to obtain.* The rate of increase of the population during the years 1871 to 1875 is not stated; but the mortality of 399 for the Town of Newcastle on the present population, 9,350, would indicate a rate of 42·6 in 1,000, or nearly three times the number which nature demands as inevitable; no stronger reason need be urged for an improvement in the sanitary condition of Newcastle.

In one form or another water for domestic use is the occasion of considerable expense to the inhabitants of the entire district, either in the construction and maintenance of tanks for storing roof-water, or in the form of cash payments for water purchased by the cask; while it has been found necessary, on some occasions, to convey water from Maitland to the mining townships by railway.

The provision of a constant supply of good water will, I believe, not only remove the cause of much unnecessary sickness and mortality, but will materially assist the coal-producing industry of the district, by removing one of the greatest difficulties to comfortable residence therein.

From inquiries I have made, there will I think be little difficulty in selling water to the population of the various townships, who will be prepared to pay a reasonable price for a good and constant supply.

Under these circumstances I would advise that the Government assistance, in whatever form it may be given, should be for the purpose of providing the water in reservoirs situated in convenient positions for distribution, but that the works for distributing it should be left entirely in the hands of the various Municipalities who will use it.

The following Report will therefore be confined to the provision of the water as proposed.

The expense of a system entirely confined to pumping of water through pipes extending over a distance of $22\frac{3}{4}$ miles between the source above West Maitland and Newcastle will necessarily be considerable, and in the works which I recommend I have endeavoured to reduce the cost to the lowest limit consistent with the efficiency and permanence of the supply.

In addition to the population, the shipping in the port of Newcastle will also require to be supplied; for this, and other purposes connected with the port, Mr. Darley, the resident Engineer, informs me that a daily supply of 12,000 gallons will be required.

The question of quantity to be supplied daily for this population is one of great importance, as on it depends to a considerable extent the cost of the works, in which, as above intimated, a pipe $22\frac{3}{4}$ miles long will form the largest item of cost in the scheme.

Where there is no waste, twenty gallons per head of the population per day is an ample supply for all domestic purposes. Watering of streets and gardens very considerably increases the quantity required; it is, however, not desirable that the quantity supplied should be so limited as to necessitate an immediate addition to the works on their completion, should an increased demand arise, as it will inevitably do, when the water comes into general use. I consider therefore that the works should be easily capable of delivering $35{,}069 \times 30 = 1{,}052{,}070$ gallons per day, and for this quantity the works presently to be described are designed.

The locality where the water will be taken from the river, and the situation of the filtering works, is shown in the plan, No. 4.

The floods in the Hunter rise upwards of 30 feet above the usual level at Bolwarra, and it will therefore be necessary that the proposed works should be constructed at such an elevation as will effectually exclude flood water.

This point is very favourable for the proposed works; at a distance of 30 chains from the river a hillside affords an excellent position for the various tanks, filters, &c., and a little further on the Walka Lagoon occurs, which forms an admirable site for a storage reservoir (*Vide* plans Nos. 2 and 4.)

This

* Appendix, page 15.

The section at the distorted scale 20 chains to the inch horizontal, and 40 feet to the inch vertical, appears to be very rough, but the hills are not very precipitous, and the surface is generally decomposed to a sufficient depth to render cutting in the hard rock unnecessary. Crossing a few of the narrow ravines, it will be desirable to elevate the pipe slightly to prevent abrupt changes in its vertical direction; horizontally there are very few places which will require special pipe castings.

For the elevation of the pipes across the ravines referred to, the most economical way will be to carry them on piles formed of the bush timber through which the line is carried. A pile under each 12-foot length of pipe would be necessary, and the whole covered with a roof to exclude the sun and prevent expansion. A cheap arrangement for carrying the pipe at an elevation of 15 feet is given in plan No. 8, which would cost but little more than the excavation in other places.

It would be necessary, if this be adopted, that it should be confined to those places where timber is not brought down in times of flood; in such cases, and there are but two or three only, trestle bridges would be required to carry the pipes.

To prevent damage from bush fires, the places where these occur would require to be kept clear of timber and long grass; this would be the duty of the Pipe Inspectors, who would be kept for the purpose of examining the pipe line from end to end about twice every week, to ascertain that no leakage had occurred, and to effect simple repairs when necessary.

It will be necessary when the final surveys are made for fixing the line of pipe to avoid, as far as practicable, those places where the coal has been worked from under the surface, and where this cannot be done to support the roof of the workings and prevent subsidence. In all future workings such supports can be left, and this should be insured by legislative enactment, so as to prevent the destruction of the pipe and interruption of the supply of water.

Various forms of valves will be required in the pipe, the principal of which are air-valves to permit the escape of air from the pipe while being charged, and also for the prevention of accumulations of air in the high points of the route, the presence of which obstructs the flow of the water.

Reflux valves, to prevent the return of the water from the higher levels of the pipes, should a burst occur in the lower portions.

Safety-valves, to prevent the bursting of the pipe on the too sudden closing of a valve and stoppage of the flow of water. If all these points are carefully attended to, the pipe will act perfectly to supply the various reservoirs, notwithstanding the uneven character of the country through which the pipe is carried.

In order to preserve the purity of the water, it is desirable it should be kept in covered reservoirs after passing through the filters, not only to exclude leaves, dust, &c., &c., but also the light, which engenders the growth of vegetable organisms; all the reservoirs proposed are therefore to be covered with a roofing of galvanized iron supported on suitable timber.

The whole of the reservoirs will be formed either in decomposed or solid rock capable of standing perpendicular when excavated, and will therefore only require lining with impervious material to make them water-tight. Both at East Maitland and Newcastle the rock appears to be decomposed at the surface, and the cheapest form to be given in such case is circular, lined with masonry and puddle, after the manner of gas-holder tanks, or with cement rendering where puddle is not procurable. A sketch of such a tank, with inlet, outlet, and overflow arrangement, is given on plan No. 9.

Tanks similarly constructed are provided for in the estimate at the other places named at page 6. When, as at Butti Hill, the reservoir will be in the solid sandstone, the circular form need not be given, as the roofing of a quadrangular tank will be more simple; this tank will only require partial lining where fissures and defects occur in the rock.

Arrangements will be made in connection with the outlet pipes to draw off the water from the tanks entirely when cleansing or repair is required.

At Newcastle there are a few houses above the level of the ground near the Light-house, which is 158 feet over high-water. The level of the outlet at Butti

Butti Hill is 265 feet above the same; it is evident therefore that if the pipe be not drawn upon on the route the water would rise to this latter elevation at Newcastle, and fill a reservoir placed on the Obelisk Hill (which is 216 feet over high-water) to receive it. This could be accomplished during a short period of the night, when there is no draught on the pipes; and should the time come when the pipe is required to be constantly at work to supply lower levels, it will then be necessary to provide a small engine and pump to lift the water required for the higher service into this tank. This latter arrangement is not included in the estimate.

The above is a general description of the works necessary to supply easily, that is in fifteen hours' working of the engines, one million gallons per day, while the pipe to Newcastle is capable of supplying 1,143,000 gallons per day, and to Maitland reservoir, 300,000 gallons.

If, therefore, the demand should increase, and the engines be worked continuously, as they would be capable of doing, the daily supply may be increased to 1,443,000, or nearly 1½ million gallons.

The estimate for the work is as follows :—

Storage reservoir, containing 75,000 cubic yards, complete with puddle-wall, pitching surface of slope, inlet, outlet, and waste-wier, &c.	£7,801
River water-tank, 3 filters, clear-water tank, inlet and outlet pipes, &c.	15,128
Engine, 215 horse-power, effective, with ⅓th additional boiler, pumps, connecting pipes, engine and boiler house, chimney, &c., &c.	19,398
Suction and delivery pipes between river and reservoir, and connecting pipes between tanks, filters, &c., &c.	6,448
Piping from Maitland to Newcastle, with branches to district reservoir, 8,373 tons, sluice cocks, air and safety valves, &c....	94,657
Service reservoirs, and connections	10,879
Land, fencing, compensation, and houses for establishment ...	5,128
Engineering and contingencies	10,561
Total	£170,000

The estimated cost of working when delivering one million gallons per day is as follows :—

Establishment.	
1 engineer superintendent, per annum	£350
2 engine tenders and 1 mechanic, at 10s. per day	546
2 firemen, at 8s.	300
2 labourers with filters, at 7s.	256
2 pipe-layers on pipe line, at 8s.	300
	£1,752
Coals, per annum	900
Oil, tallow, and waste	200
Repairs to engines, &c....	300
Total working expenses, per annum	£3,152
Interest on £170,000, at 5 per cent.	8,500
Total annual expenses	£11,652

or at the rate of about £33 per day.

At this rate the cost of the water placed in the reservoirs ready for distribution will be 8d. per 1,000 gallons.

Should the demand for water increase, and the consumption amount to 1,400,000 gallons daily, the working expenses will be increased by £3 6s. per day, but the cost of the water will be reduced to 6¼d. per 1,000 gallons.

It will be desirable that the construction and management of the works here described should be left to a permanent Board or Commission of five persons, of whom three should be nominated by the Government and two elected by the Municipalities for three years, and these latter should retire by rotation.

An Act of the Legislature would be required constituting this Board, and to empower them to employ necessary assistants in the form of a permanent Staff, to make contracts, and to carry the works through and under private lands and buildings, when necessary, with the right to inspect and repair them in such places after completion, in all cases making compensation for damage, also to levy rates for the use and sale of the water, and to provide penalties for the injury of the works, the pollution of the water, &c.

The

The assessment of the various Municipalities for the supply of water furnished to them should be regulated by the Commission, and a minimum annual sum from each of the Municipalities should be guaranteed for the payment of interest, &c., considered in connection with such assistance as may be given by the Government.

For this purpose I would further recommend that a small rate be levied by the Municipalities through which the works will be carried, and that this be made to cover the cost of the water supplied from public stand-posts in the streets and roads, and that all persons requiring to have a tap on their premises should wherever practicable be supplied by meter, and the payments for such extra supply shall be regulated by the Commission.

At page 5 I have recommended that the works for distributing the water shall be left to the various Municipalities. I have not gone very closely into this subject, as it is only a few of the towns that have the necessary plans and data whereon to found an estimate; it may be considered however that the cost of distribution works will be approximately as follows:—

West Maitland, 9½ miles pipes with stand-posts, fire hydrants, &c., would cost				£8,500
East Maitland, 4½	do.	do.	do.	... £3,500
Newcastle ...17	do.	do.	do.	...£18,000

I have not considered it necessary for the purpose of this inquiry to make detailed drawings, &c., sufficient for the carrying out of the works—it would have occupied too much time; I have, however, sufficiently indicated the nature of the work proposed, and the necessary information has been obtained for furnishing drawings and details when required.

Similarly with the pipes for distribution, when the plans and levels of the townships are completed, all the information required can at any time be supplied.

It is necessary to mention that the estimate, £170,000, includes 9,000 tons of cast-iron piping, and is, I consider, ample; as, however, this is the principal item of cost, should any considerable increase take place on the present very low price of this material, the estimate would require to be increased.

In concluding this Report on a subject of the greatest importance to the district interested, I desire to record my thanks to the following gentlemen:—T. E. Wallace, Esq., Mayor of Newcastle; G. T. Chambers, Esq., Mayor of East Maitland; James Wolstenholme, Esq., Mayor of West Maitland; and the Aldermen of the latter town, appointed as a Committee to receive me. These gentlemen, at a considerable sacrifice of time, gave me every possible assistance in my examination of the country, and valuable information on the current rates for work and material, and every other subject connected with the inquiry. To Mr. Surveyor Fuller also my thanks are due for the efficient help rendered to me in connection with the levels, surveys, &c., the making of which was intrusted to his management.

W. CLARK,
Member Institute of Civil Engineers.

October 8th, 1877.

APPENDIX.

APPENDIX.

Mr. Fuller's Report.

Sir, Newcastle, N. S. Wales, 17 July, 1877.

I have the honor to report to you that, in accordance with your instructions, received Monday, the 2nd instant, I proceeded to make a survey of the proposed line of Waterworks from Salt Water Creek to Newcastle. On Thursday, according to arrangement and at your request, I accompanied the Mayor of Newcastle to the Lagoon at the southernmost end of the *supposed* watershed, and tasted its water. The result was that we found it so brackish that it was considered unfit for drinking purposes.

On my journey from Red Head Lagoon towards this Lagoon, which I will in future designate as the "*Salt Water Lagoon*," I noticed the flow of water was southerly, and on especial inquiry as to where the water came from to supply the Salt Water Lagoon, and where it flowed to, I was informed that the supply came from the north and flowed south into Lake Macquarie. This was so diametrically opposed to Mr. Francis Bell's report that I thought it advisable you should be acquainted with it, and for that purpose the Mayor proceeded to Bathurst to so inform you, while I wrote to the Surveyor General a private report of my surmise, and requesting instructions to allow me to verify my impressions or not, as, if proved correct, at least one-half of the supposed catchment area would be cut off from Salt Water *Creek*. I received permission on Monday, the 9th instant, to proceed with the flying levels necessary, and on Tuesday, the 10th, I was enabled to come into Newcastle with the information that about four miles from the mouth of Salt Water Creek, in a south-westerly direction, around the swamp, a barrier existed of (46) forty-six feet in height of sand-hill, overgrown with scrub and gum, dividing the waters at this point and causing them to run respectively north and south. I then received instructions from you to verify my work by carrying the flying levels on to the Salt Water Lagoon, and thence to approximate sea level, and also to prove the water level of Lake Macquarie. On account of the gale on Friday and Saturday I was unable to proceed with my work till Monday, the 16th, when I waded across Salt Water Creek to my old marks and carried on my levels to Salt Water Lagoon. The level of this water I found to be 3·7 feet above approximate high-water-mark; and, as we tested the depth of this Lagoon, when on it on Thursday, the 12th, to be 3′ 11″, therefore the bottom of the Lagoon is below high-water-mark. Again, as there is no doubt that the water in this Lagoon was at *this* time some two feet above its previous height, the bed is *considerably* below high-water-mark.

From the then height from the water in the Salt Water Lagoon I ran my levels over the sand-hummocks towards the sea, and was astonished to find the sea running up the sand to the height of 16 feet above its ordinary level, thus being higher by 12′ 3″ above the water as then resting in the Lagoon. Being thus satisfied that the impregnation of salt would be permanent, I returned to the Lagoon and took my levels towards Lake Macquarie, and found a fall that day of 18 inches. I went to the outlet, which was running with *great* velocity, and took the level of the *bottom* of the Creek, and found I tied in to high-water-mark, as *minus* 0·150 of a foot, the water of the lake being 2·200 above my approximate high-water-mark. On inquiry, however, at Mr. Anderson's, the owner of the land between the lake and Lagoon, he informed me that the lake was quite two feet higher then than at our previous visit, on account of the gale. This, as you will see by my level book, ties in so accurately with my approximate high-water-mark, that I am perfectly satisfied as to its correctness.

My investigation as to this point is, therefore, ended, and I have to report that the catchment area of Salt Water Creek alone is thereby reduced to about 1,500 acres, with a few more for creek drainage, which would include about another 1,000 acres.

FRANCIS J. FULLER,
Engineer and Surveyor, Sydney.

W. Clark, Esq., to The Mayor and Council, West Maitland.

Gentlemen, West Maitland, 31 July, 1877.

I am now engaged, as you are aware, on an inquiry as to the best means of supplying your town, and also East Maitland, the Mining Townships, and Newcastle, with water.

It is a matter of the greatest importance that the permanence of the source of supply—the river Hunter at Dickson's Falls—should be ascertained and confirmed on the best evidence available. As there are no actual records of the stream during periods of drought that I am aware of, I shall feel obliged if you will inform me on the best information you can procure on the following points:—

1st. Is the river ever known to be brackish at the point above named?
2nd. During periods of severe drought has the river ever been known to cease running?
3rd. If not, what may be considered the smallest stream, as to breadth, depth and velocity?
4th. If it has ceased, for what period?

Yours, &c.,
W. CLARK.

The

The Council Clerk, West Maitland, to W. Clark, Esq.

Sir, Borough Council Chambers, West Maitland, 6 August, 1877.

In reply to yours of 31st ultimo, requesting that our Council would furnish you with the best possible information respecting the state of the river Hunter at Dickson's Falls, I have much pleasure in submitting documents from the following persons, whom you will perceive are very old residents, and consequently well qualified to afford the information sought:—

Mr. James Moy	refers to	51 years ago.
Mr. John Eckford	„	59 „
Mr. Thomas Evans...	„	49 „
Mrs. Risby	„	39 „
Mr. Robt. Scobie	„	37 „
Mr. Isaac Gorrick...	„	30 „
Mr. Rourke	„	40 „

Mr. J. B. R. Robertson is an old resident, but does not give any date.

I beg further to intimate that the above information has been duly submitted to this Council, who, having the greatest confidence in the persons named, have requested me, on the motion of Alderman Chapman, to convey the documents to you with their concurrence in the contents.

I have, &c.,
THOS. HUGHES,
Council Clerk.

Pitnacree, 4 August, 1876.

Hearing that Mr. Clark was desirous of ascertaining from old residents whether the river at Dickson's Falls was ever known to be brackish, and also whether at same place the river was ever known to have ceased running, I have known the locality named since the year 1818, and during the whole of that period I have never known the river water brackish at Dickson's Falls, but have known it brackish at Risby's Falls.*

* 1¼ mile below Dickson's.

During the same period, I have never known the river at the point named to cease running; have known the river crossable dryshod at a point near Aberglasslyn.

JOHN ECKFORD.

Answers to Questions.

1. Is the river ever known to be brackish at Dickson's Falls? The river has been brackish up to Dickson's Falls, but not above it; the tide does not flow over the Falls. This is my experience for thirty years.

2. I have always observed the water running at the falls referred to, but the stream has been greatly reduced in very dry seasons; still there has been a large body of fresh water above the falls in the very driest seasons.

3. This is impossible to answer, because a large quantity of water passes through the gravel or shingle unobserved. The shingle extends across the bed of the river in this locality, and some feet in depth.

4. The fourth question is answered by the second.

ISAAC GORRICK.

P.S.—There were no floods in the Hunter from the year '40 to '57.—I.G.

Mr. Prichard. 1 August, 1877.

West Maitland, 2 August, 1877.

In answer to questions in reference to the state of the river at Dickson's Falls in time of drought, I beg to say that I have lived in this town for the last forty-nine years, and have good opportunity of noticing the state of the river. I can confidently say that during that period the river at the above place has not been brackish. At the West Maitland Falls the river has been slightly brackish, but the people dug holes at the sides of the river and could then use the water.

At Dickson's Falls the bed of the river is coarse gravel, and for a short time during the most severe drought the water did not cover the gravel, you could walk across dry, but it ran through the gravel at the driest time. Above Dickson's Falls there has always been a plentiful supply. I have known the time when the people of Morpeth had to obtain their water from this place.

THOMAS EVANS.

The undersigned has lived on the river at the above place for the past fifty-one years, and certifies to the truth of the foregoing statement. JAMES MOY.

The undersigned having lived at the Maitland Falls for thirty-nine years and in the neighbourhood for forty-four years, certifies to the truth of the foregoing statement. M. RISBY.

In answer to questions, my knowledge is as follows:—To No. 1—no; to No. 2—no. As to question No. 3, cannot say, as a large quantity escapes through the sand. The fourth question is already answered.

I also wish to state that in my opinion there would be an abundant supply if even the river ceased to run, as there are large reaches of very deep water. J. B. R. ROBERTSON.

Mr. R. Scobie to The West Maitland Municipal Council.

Gentlemen, Maitland, 4 August, 1877.

In answer to the questions in reference to the state of the river Hunter at and above Bolwarra Falls in times of drought, I beg to state, firstly, that I have not known the water to be brackish above Bolwarra Falls.

Secondly,—

Secondly,—I have not known the river to cease running at the above place except at the turn of the tide. Last summer being very dry, I think a two-foot pipe would have passed all the water that crossed the gravel bed called the Falls at the lowest condition of the river; the fall over this gravel bed in times of drought is from a foot to 20 inches. During all droughts that I recollect, excepting the one of last summer, the effect of the tide was visible here, causing an up-stream over the gravel bed at high-tide, which could easily have been stopped by a temporary obstruction of loose stones, gravel, &c. The absence of tidal effect so high up last summer is probably caused by the filling of the river channel lower down with sand, &c., thereby preventing the tide water from coming up in sufficient body to reach so far. There is a large deep reach of permanent fresh water above the Falls, the bottom of which is many feet below sea level; this place above the Falls in times of severe drought would receive the whole of the water coming down the Hunter bed, through gravel, or otherwise, and should retain it, owing to its low position.

My observations extend from the beginning of the year 1840.

I am, &c.,
ROBERT SCOBIE.

Reply to Questions asked by Mr. Clark.

West Maitland, 7 August, 1877.

I have resided upon the Hunter in West Maitland over (40) forty years, and can speak accurately of the river. I have never known it to cease running at Bolwarra Falls in the driest seasons; in that particular locality the river has shoaled up across its bed with an immense sand-bank interspersed with gravel, consequently the flow on the surface is diminished; nevertheless there is a considerable under-current. Immediately above the Falls there are large reaches of deep water extending upwards to the Melville Ford, about 4 miles; some of the rocky holes are probably 40 feet in depth, and I should suppose there is an average depth of 15 feet of water; where the intended works are to be erected the water is pure and soft. The river upward to its source runs over a gravelly bottom, and the water is not under tidal influence.

HENRY ROURKE.

Professor Liversidge to The Principal Under Secretary.

Sir, The University, 20 August, 1877.

I have the honor to forward herewith the results of my analysis of the three samples of water from the Hunter River, supplied by the Municipal Council of West Maitland, at the instance of Mr. W. Clark, Hydraulic Engineer.

I have, &c.,
ARCHD. LIVERSIDGE.

The Council Clerk, West Maitland, to W. Clark, Esq.

Dear Sir, Borough Council Chambers, West Maitland, 4 September, 1877.

In reply to yours, just received by our Mayor, relative to the three samples of water sent to Sydney for examination, I have much pleasure in stating for your information that they were obtained from the following places:—

No. 1. From the rear of the Wesleyan Cemetery.
No. 2. From near "Dickson's Falls."
No. 3. From near Aberglasslyn.

I am, &c.,
THOS. HUGHES,
Council Clerk.

Sydney, 20 August, 1877.

REPORT upon three samples of water from the Hunter River, supplied by the Municipal Council of West Maitland, at the instance of Mr. W. Clark, Hydraulic Engineer. Each sample was contained in a single Winchester quart bottle closed with a cork and cemented with wax.*

Sample No. 1.

Colour, &c.—When viewed in a large, clear, and colourless glass flask this sample exhibited a brown shade and great turbidity. Moving about in the water were a few entomostraca and other organisms visible to the naked eye. A heavy clay-coloured sediment was deposited by this in common with the other two samples.

The water did not clear itself, on standing for a few days, as is usually the case, but remained milky to the last.

Taste.—None.

Smell.—A very slight earthy smell.

In the unfiltered state the water yielded the following results:—

Free ammonia	·18	parts per million.
Albumenoid ammonia	·24	" "
Chlorine	41·85	" "
Nitrites present in rather large quantity.		
Total solid matter	212·00	parts per million.
Loss on ignition	58·00	" "
Fixed solid matter	154·00	" "

To remove the bulk of the solid matter in suspension a portion of the water was passed through well-washed Swedish filtering paper, and the chief of the above items redetermined.

The

* Sealing-wax or other cement ought not to be placed directly on the cork or stopper; the stopper should be tied over with a piece of clean calico or linen, upon which the seal may, if necessary, be placed.

The following figures show the beneficial effects of so doing :—

Colour.—Still somewhat milky.

Free ammonia	·10	parts per million.
Albumenoid ammonia...	·20	„ „
Total solid matter	190·00	„ „
Loss on ignition	56·00	„ „
Fixed solid matter	134·00	„ „

The residue left after evaporation to dryness was brown in colour, rather bulky, and gave off a slight smell of organic matter. On ignition this residue blackened very much. An excessive blackening indicates the presence of a considerable amount of organic matter. After the whole of the carbon was burnt off the residue was white mixed with brown in parts, the brown patches being due to the presence of iron oxides.

Composition of the residue.—The quantity of water placed at my disposal was insufficient to make a quantitative analysis of the inorganic matter in solution; a qualitative examination, however, showed that the salts in solution consist for the most part of the usual compounds of iron, alumina, magnesia, lime, soda, silica, sulphuric acid, and chlorine, found present in most spring and river waters.

None of them are present in an excessive amount, and they should in no way affect the quality of the water for drinking purposes.

Microscopical examination.—The amount of sediment was excessively great. It consisted principally of silty matter. The usual infusorial organisms were present, but not in large numbers.

Sample No. 2.

Colour, &c.—Very much the same as No. 1.

Taste.—None.

Smell.—A very slight earthy smell could be detected.

Free ammonia	·12	parts per million.
Albumenoid ammonia...	·26	„ „
Chlorine	41·85	„ „
Nitrites	Absent.	
Total solid matter	202·00	parts per million.
Loss on ignition	54·00	„ „
Fixed solid matter	148·00	„ „

The same water, after filtration through Swedish paper, *i.e.*, without the solid matter in suspension, yielded the following results :—

Free ammonia	·06	parts per million.
Albumenoid ammonia...	·18	„ „
Total solid matter	178·00	„ „
Loss on ignition	52·00	„ „
Fixed solid matter	126·00	„ „

Microscopical examination.—The same appearances were presented as by sample No. 1.

Composition of the residue.—Similar to sample No. 1.

Sample No. 3.

Colour, &c.—Very similar to Nos. 1 and 2, but a shade less turbid and discoloured.

Taste.—None.

Smell.—A slight earthy smell, similar to the previous samples.

Free ammonia	·09	parts per million.
Albumenoid ammonia	·22	„ „
Chlorine	49·60	„ „
Nitrides	Absent.	
Total solid matter	236·00	parts per million.
Loss on ignition	80·00	„ „
Fixed solid matter	156·00	„ „

After filtration, as in the former cases, the water yielded of—

Free ammonia	·06	parts per million.
Albumenoid ammonia...	·18	„ „
Total solid matter	206·00	„ „
Loss on ignition	68·00	„ „
Fixed solid matter	138·00	„ „

Composition of the residue.

Both before and after ignition this had very much the same appearance as those from samples 1 and 2. It contained the same chemical constituents.

Microscopical examination.—The results of the examination were similar to those yielded by the two former samples.

Remarks.—All three samples of water are much too impure to be safely used in their present state for domestic purposes. They could, however, be sufficiently purified if submitted to a vigorous and effectual system of filtration.

ARCHD. LIVERSIDGE.

To Professor Liversidge.

Sir, Sydney, 1 September, 1877.

I am favoured by the Colonial Secretary with copy of your analysis of the water from the river Hunter, three samples of which were at my request sent to you for analysis, and which you describe as "much too impure to be safely used in their present state for domestic purposes. They could, however, be sufficiently purified if submitted to a rigorous and effectual system of filtration."

As it is probable that the towns of East and West Maitland, Newcastle, and the mining townships will be supplied from this source, I am anxious that the proposed mode of treating the water should have your approval.

It is proposed to pump the water from the river into a large reservoir, upwards of 20 feet in depth, and capable of containing more than six months' supply at the rate of one million gallons per day, where it will deposit much of the matter in suspension; it will then be drawn off from a few feet below the surface and passed through filtering tanks containing 5′ 6″ of the usual filtering media—sand, pebbles, &c. —previous to being pumped through the pipes for distribution.

The late Dr. Parkes gives the following as the essential characters in relation to the dissolved constituents of good water:—

Organic matter should not exceed...	·26	parts in the million.
Carbonate of lime	277·76	" "
Sulphate of lime	52·08	" "
Carbonate and sulphate magnesia...	52·08	" "
Chloride of sodium	173·60	" "
Carbonate of soda	347·20	" "
Sulphate of soda	104·16	" "

Total solid contents, 606·80.

Unfortunately the specimens of the Hunter River water sent were not sufficient to enable you to make a quantitative analysis. As far as they can be compared, it would appear that after filtration it possesses less of the matters in solution than would, according to Dr. Parkes, be admissible in good water.

I have, &c.,
W. CLARK.

Professor Liversidge to W. Clark, Esq.

Sir, The University, Sydney, 7 September, 1877.

In reply to your letter of the 1st instant, in which you ask for my opinion upon the method proposed for the purification of the intended water supply for the towns of East and West Maitland, Newcastle, and the mining townships, I have the honor to inform you that I think the method mentioned by you will fully answer the purpose intended, provided that arrangements be made to permit the reservoir and filtering tanks to be cleaned from time to time.

The periods at which this may be necessary would be best ascertained by means of an occasional analysis of the water as delivered through the pumps.

I would suggest that a layer of magnetic oxide of iron, which is abundant in many parts of the Colony, should, if possible, be included in the filtering media, as it possesses the power of destroying organic impurities in water to a very high degree.

In reference to the quotation (contained in your letter) from the writings of the late Dr. Parkes, upon the amounts of the dissolved constituents which may be present in a good water, I may remark that although the inorganic (and harmless) matters are less, the quantity of organic impurity, as indicated by the amounts of free and albumenoid ammonia, is greater in all probability. This is further borne out by the loss on ignition which the residue undergoes, and the intense blackening which accompanies that operation—hence the necessity for an efficient filtration of the water under consideration.

I have, &c.,
ARCHD. LIVERSIDGE.

The total number of deaths for 1876 are as follows:—

Newcastle	399	Total, 628.
Wallsend	105	
Lambton and surrounding districts	124	

The zymotic diseased are:—

Miasmatic—gastric fever	2	Miasmatic—remittent fever	10
low fever	1	rheumatism	2
diphtheria	1		192
scarlatina	40		
———	1		
croup	11	Entemic diseases—syphilis	2
typhoid fever	56	Dietic —alcoholism	6
erysipelas	2	Parasitic —hydatids	1
carbuncle	2		201
dysentery	15		
diarrhœa	42		
cholera	7		

Giving an average of 32.

JNO. BURROWES,
D.R.

28 Sept., 1871.

LIST

LIST OF PLANS

Of the Newcastle and Maitland Water Supply, prepared for this Report.

1. Local sketch, showing Hunter River, Railway, and Townships to be supplied with water, and line of pipes.
2. General plan, showing pipe line from West Maitland to Newcastle, on enlarged scale, with position of reservoirs, &c.
3. Section of No. 2.
4. Plan, showing storage reservoir, site of pumping station and filters, &c., and site of reservoir for supplying Maitland and Morpeth with water.
5. Section of branch lines, and to Maitland reservoir.
6. Plan showing engine-house, filters, &c.; section showing pipe and tunnel.
7. Floating pipe for storage reservoir and section of river-water tank.
8. Supports for pipes over ravines.
9. Plan of circular reservoir.
10. Longitudinal and cross sections of dam at storage reservoirs.

Sydney : Charles Potter, Acting Government Printer.—1877.

No 1

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Do not scale

LOCAL SKETCH

SHEWING

HUNTER RIVER, RAILWAY,

ALSO

TOWNSHIPS AND LINE OF PIPES.

W. Lee Clarke M.I.C.E.

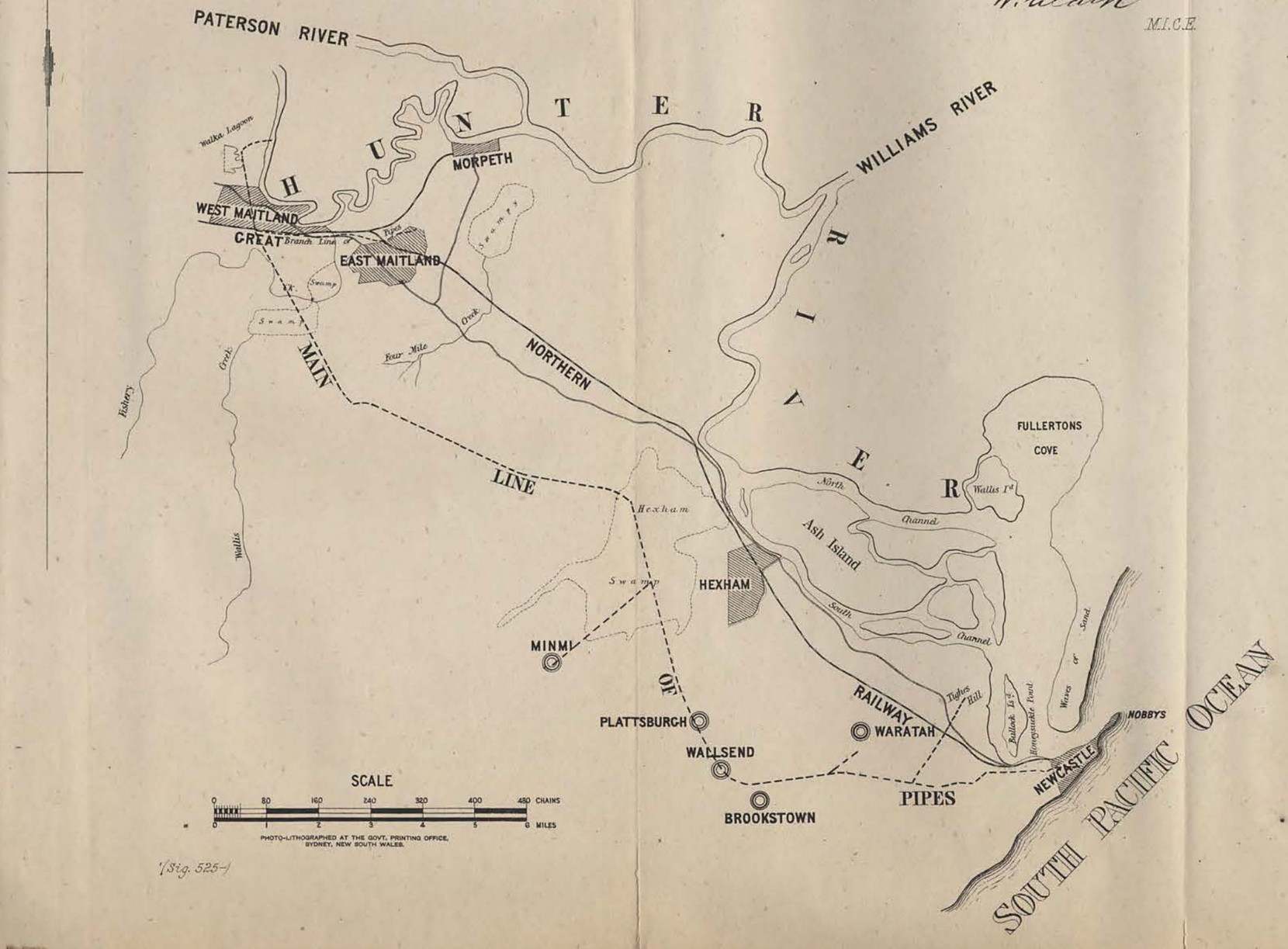

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

(Sig. 525-)

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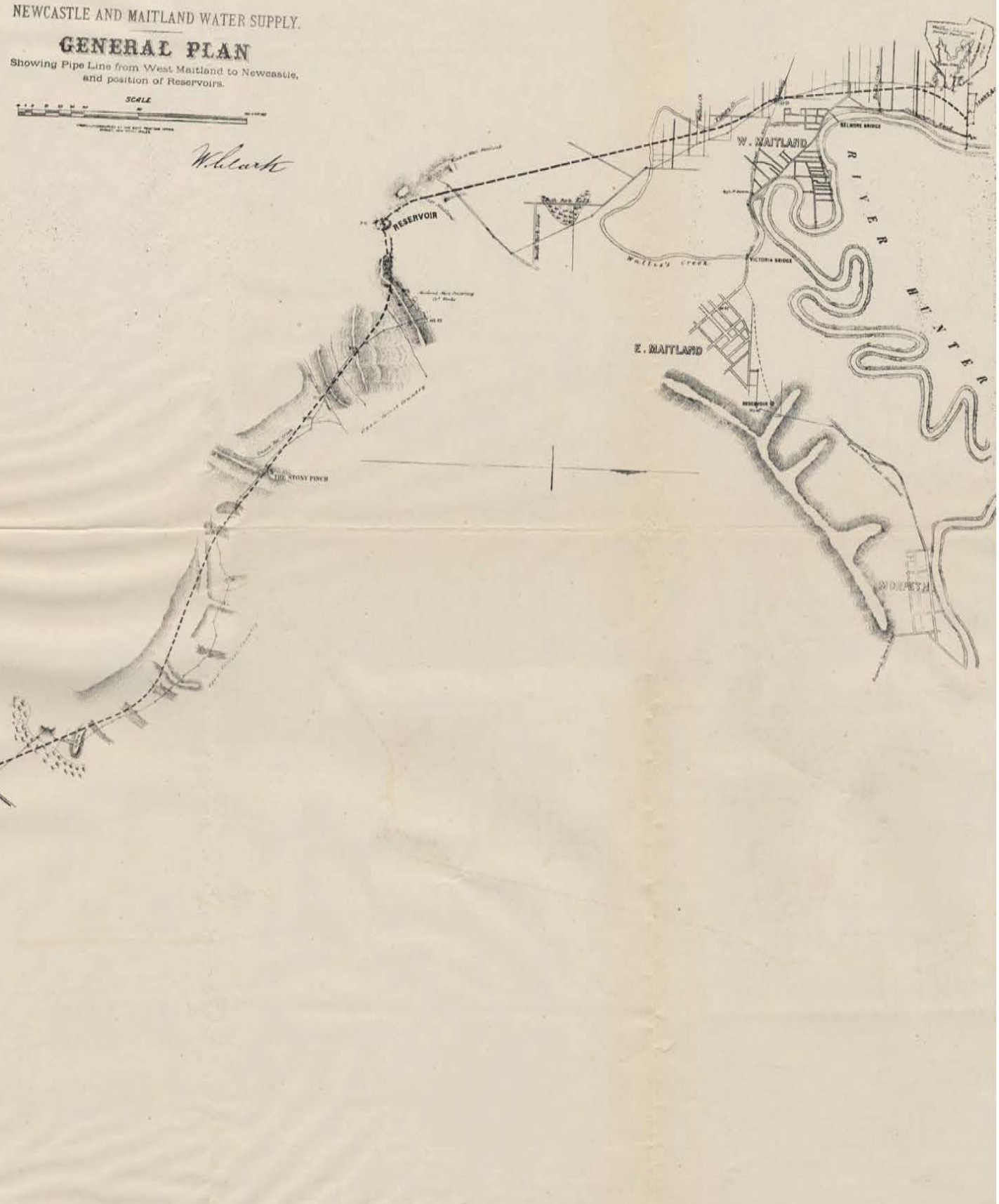
NEWCASTLE AND MAITLAND WATER SUPPLY.

GENERAL PLAN

Showing Pipe Line from West Maitland to Newcastle, and position of Reservoirs.

SCALE

W. Edwards



(525–)

LONGITUDINAL SECTION OF TRAVERSE LINE FROM RIVER HUNTER WEST MAITLAND TO RED LIGHT HOUSE NEWCASTLE

Scales

Whitearks

NEWCASTLE

HYDRAULIC GRADIENT

Nº 4.

NEWCASTLE AND MAITLAND WATER SUPPLY.

PLAN

Showing Storage Reservoir, Site of Pumping Station and Filters, &c.,
Site of Reservoir for supplying Maitland and Morpeth

Whitaker

(523—)

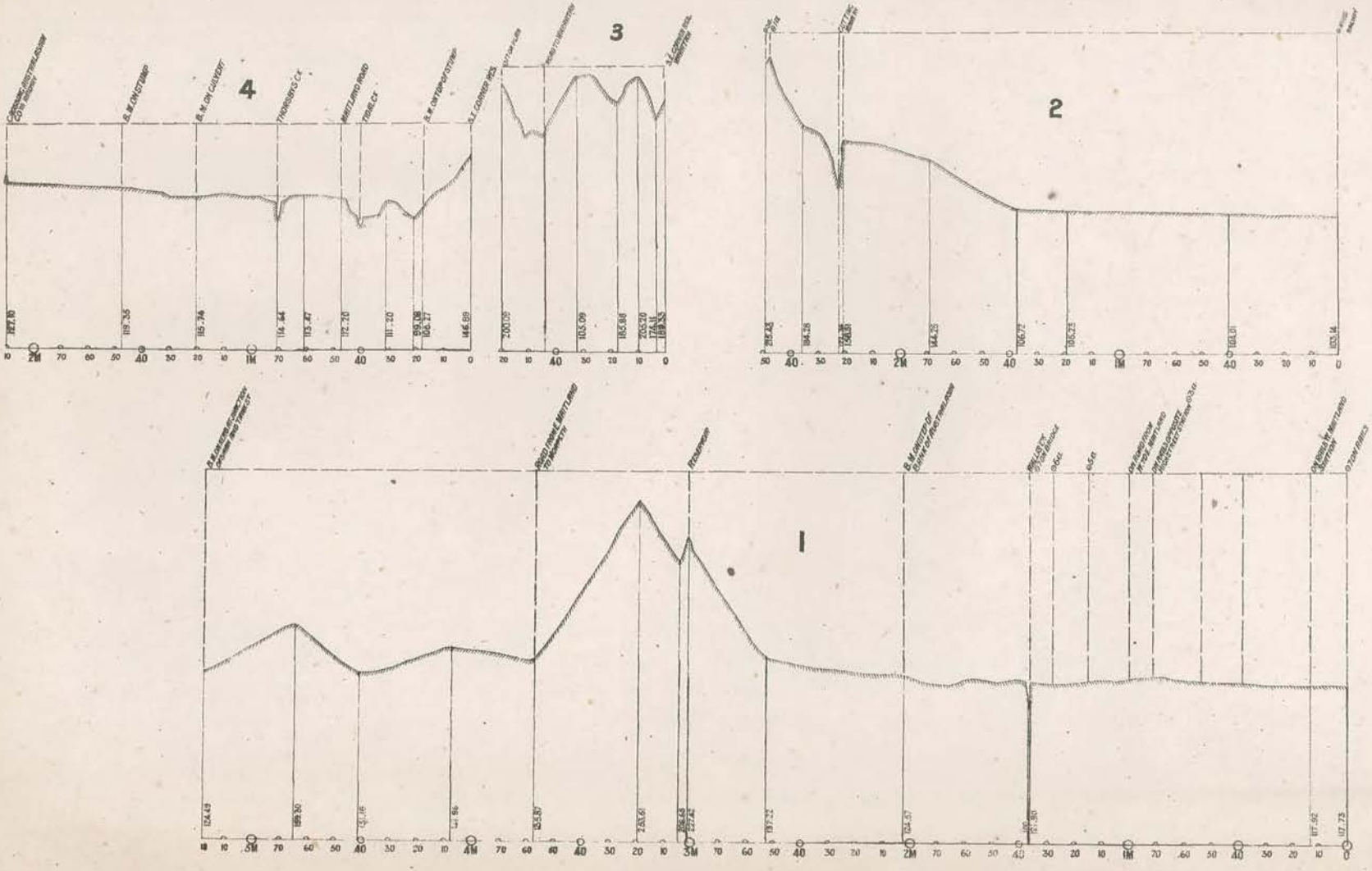
Nº 5

1. BRANCH LINE TO EAST MAITLAND
—&—
MORPETH
2. MINMI . 3. WARATAH. 4. TIGHE'S HILL

SCALES.
HORIZONTAL
VERTICAL.

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

Wlclark



(525-)

N.M.W.S. № 6

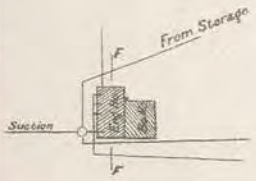
Plan

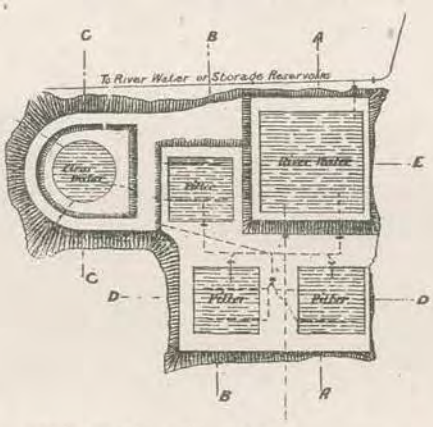
Shewing

ARRANGEMENT of WATER TANKS. FILTERS &C.

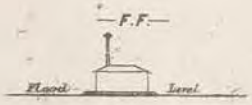
PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

W. Hilcark





SECTIONS ON LINES



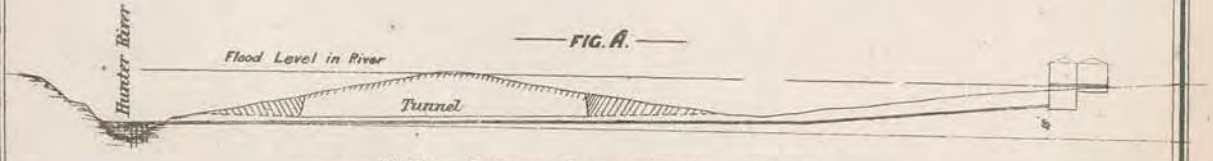


FIG. A.

Section between Engine House and River
shewing **TUNNEL** *and* **SUCTION PIPE**

N.M.W.S.

№ 7.

DESIGN

FOR

FLOATING PIPE FOR STORAGE RESERVOIR.

Scale of Feet

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

W. Clark

FIG. B.

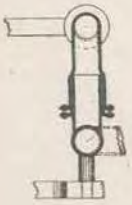


FIG. A.

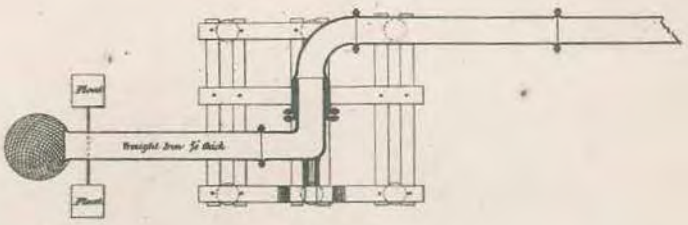


FIG. D.

Support for Pipe.

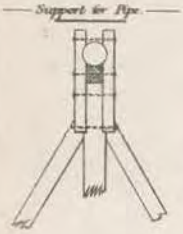
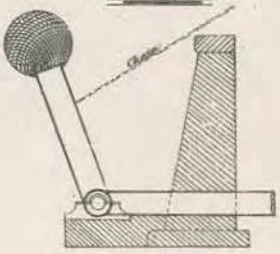


FIG. E.

Section of Wall of River Water Tank.



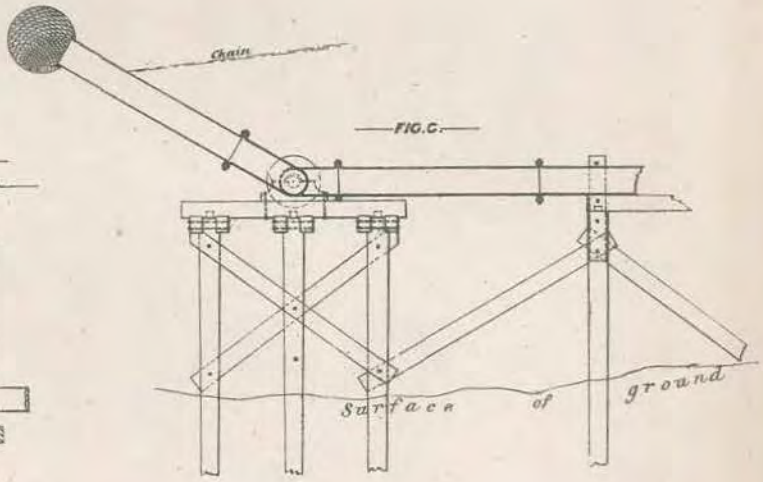


FIG. C.

(525—)

N.M.W.S.

Nº 8.

SUPPORTS for PIPE over RAVINES.

Scale of Feet

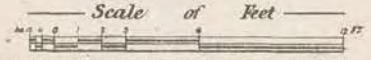
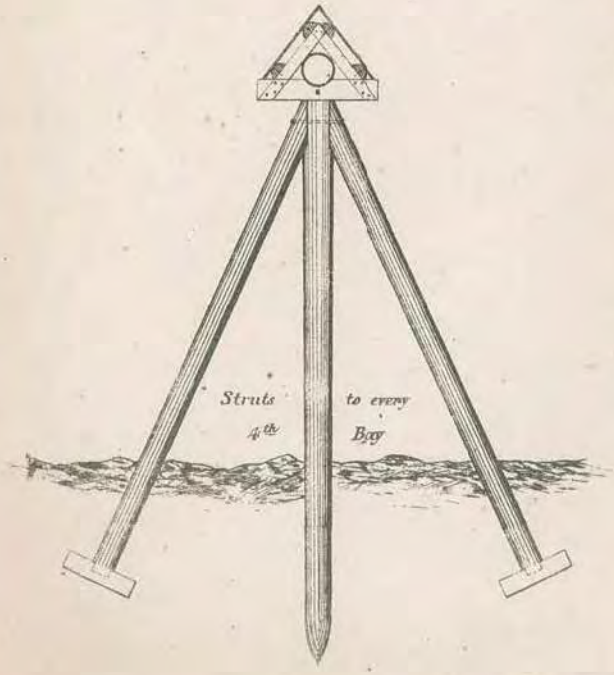


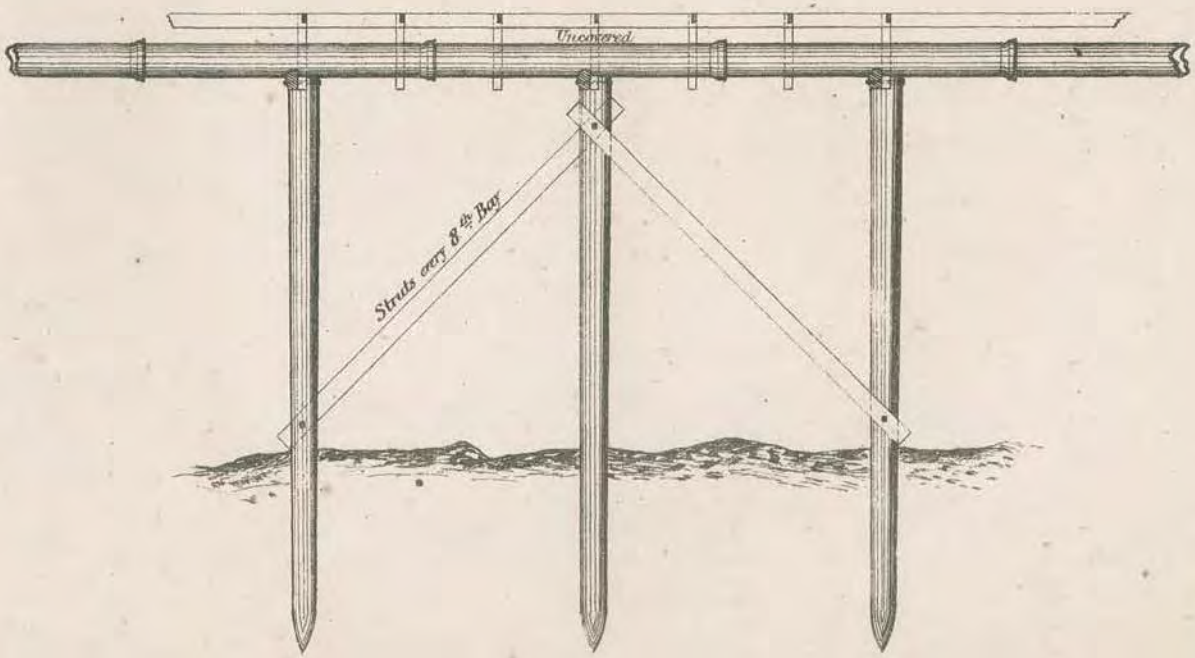
PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

W Hilark

SECTION



ELEVATION



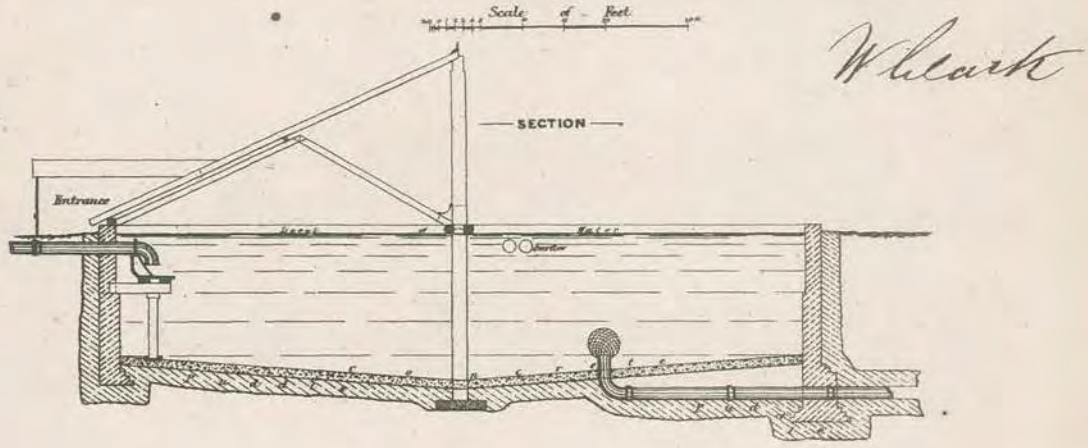
N.M.W.S.

№ 9

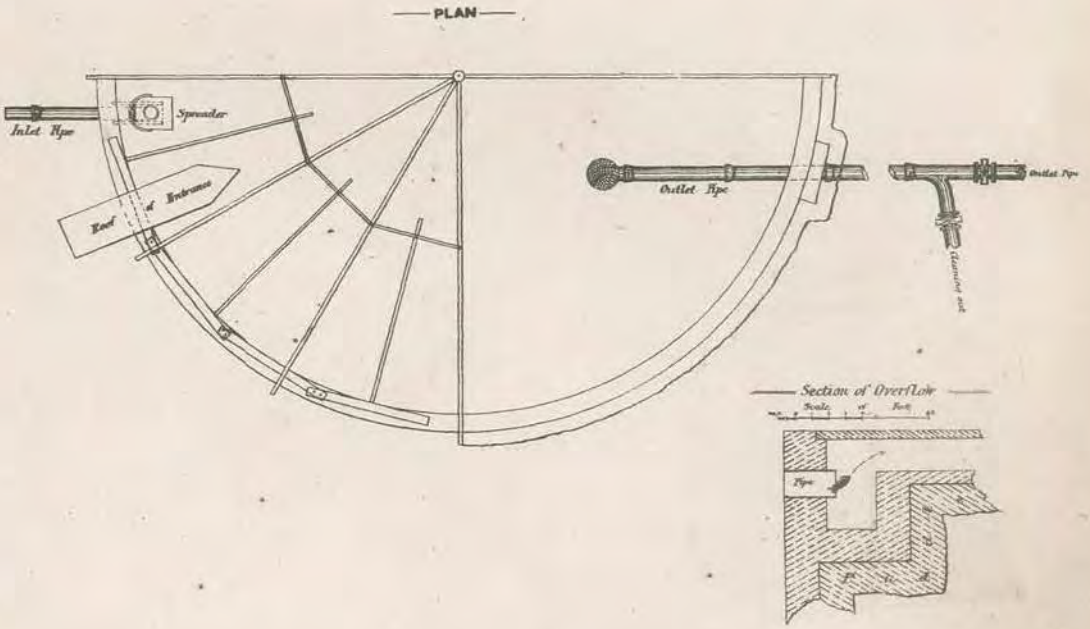
DESIGN

FOR

RESERVOIR TO HOLD HALF MILLION GALLONS



W. Clark



(525—)

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE,
SYDNEY, NEW SOUTH WALES.

SECTION OF DAM

HORIZONTAL

Scales. 0 10 20 30 40 50 60 ft

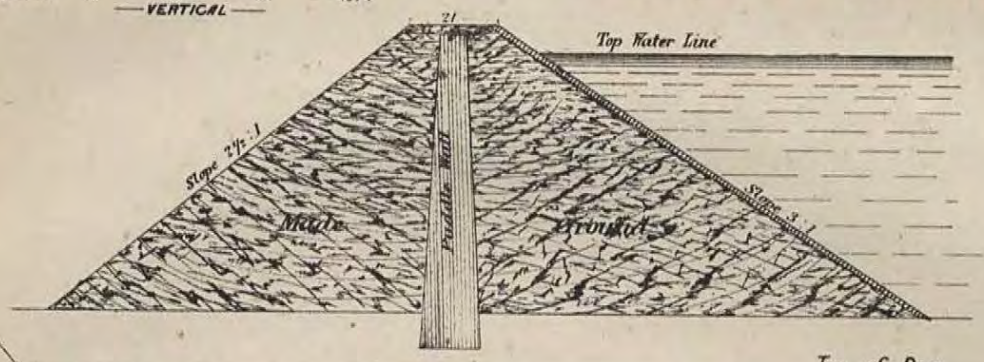
0 5 10 20 30 40 ft

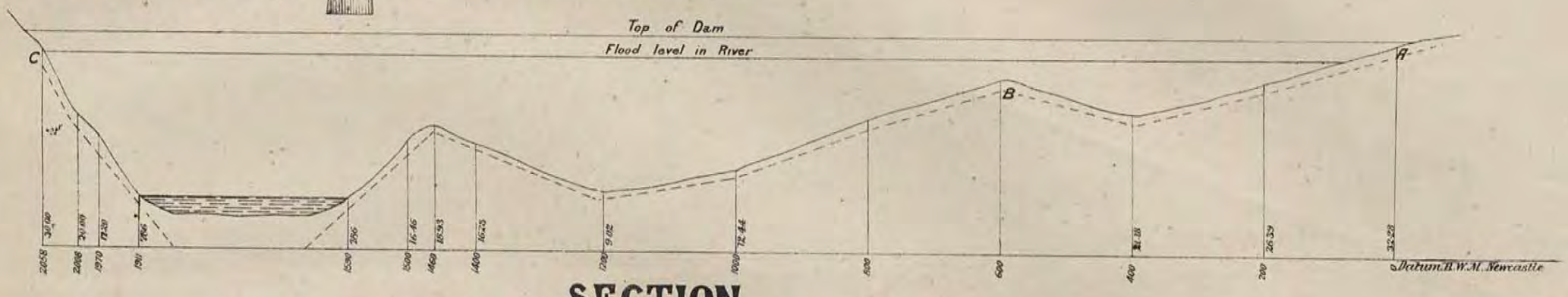
VERTICAL

WALKA LAGOON

No. 10.

W. Lilcark



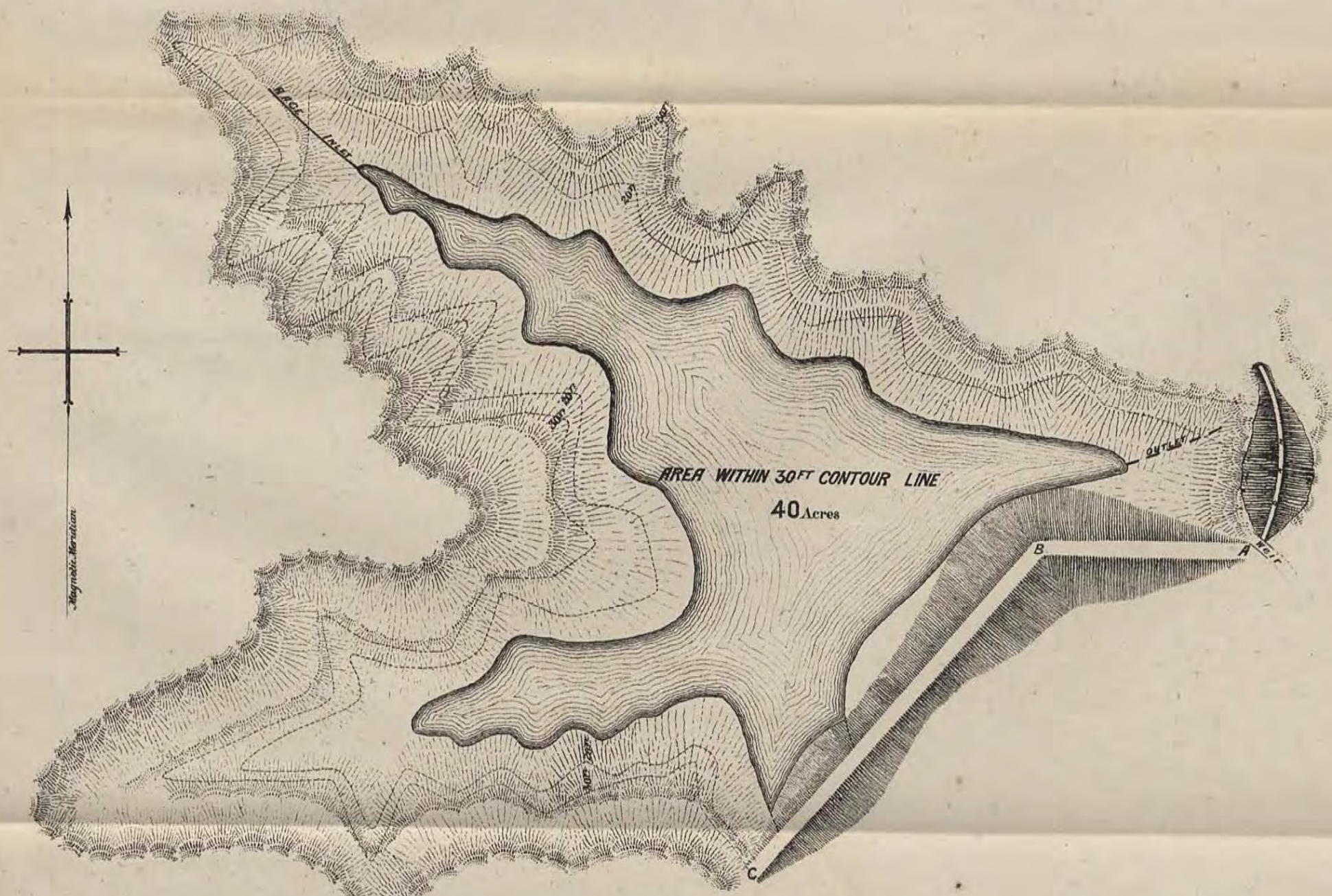


SECTION

Scales

Horizontal

Vertical



PLAN

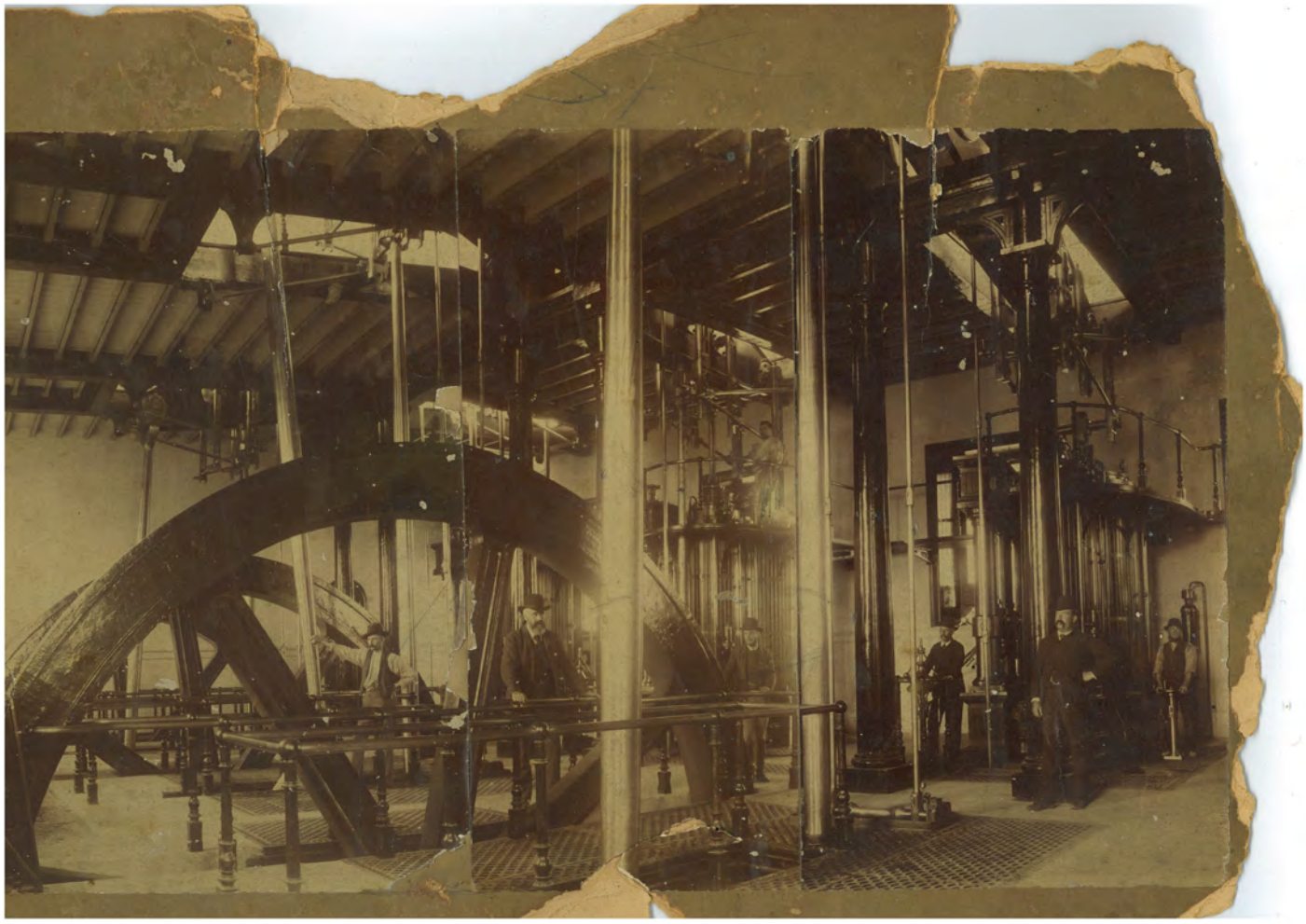
Scale

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE,
SYDNEY, NEW SOUTH WALES.

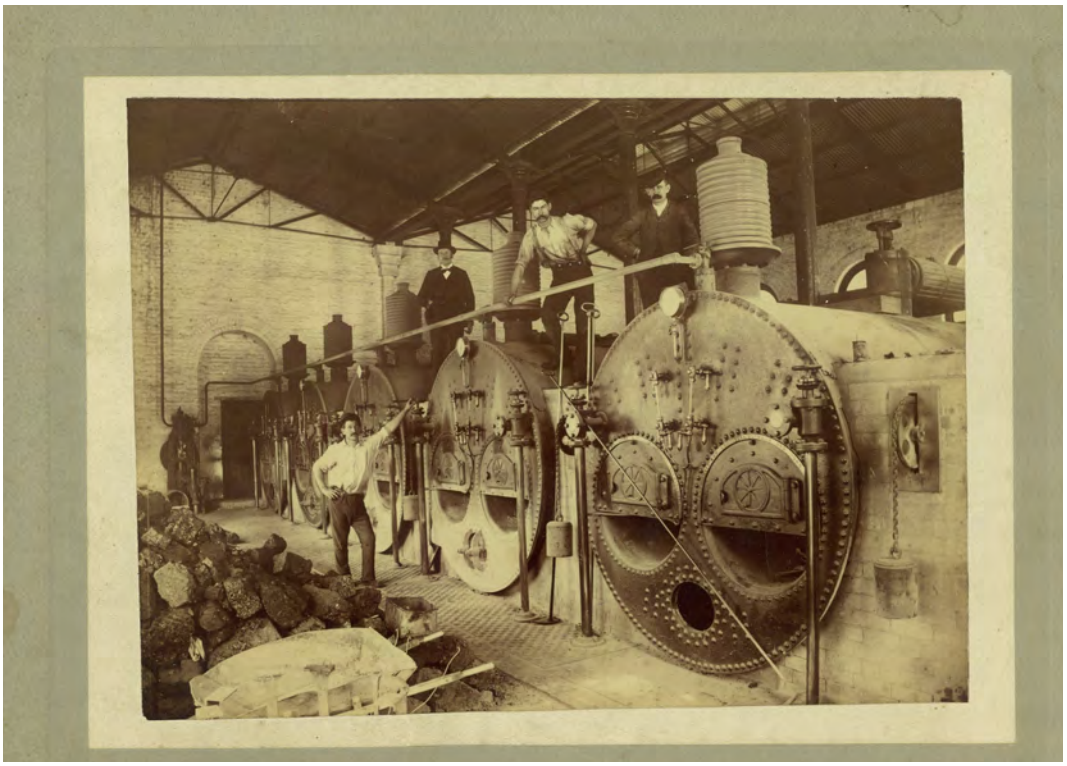
(525-)

APPENDIX C

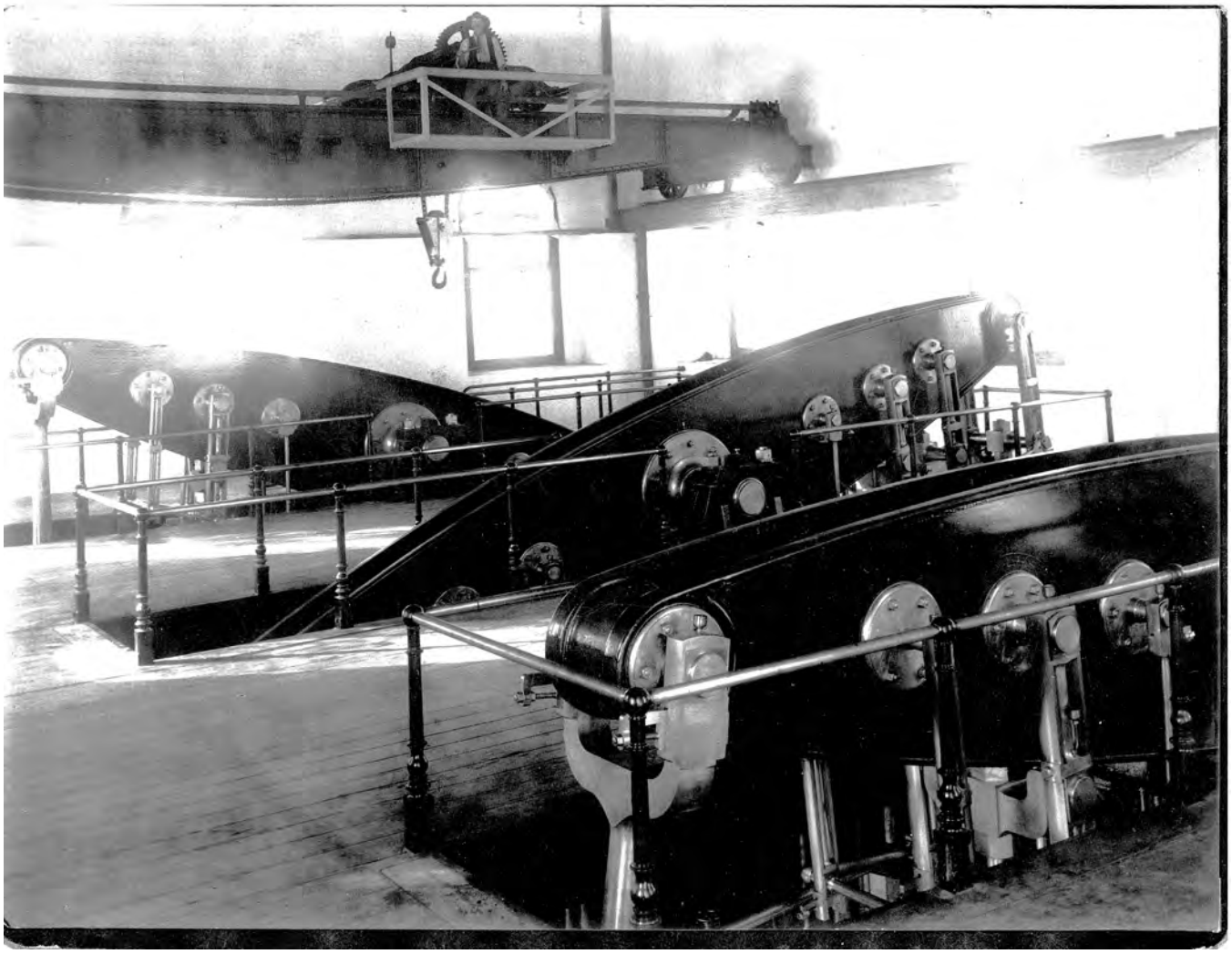
Additional historical records



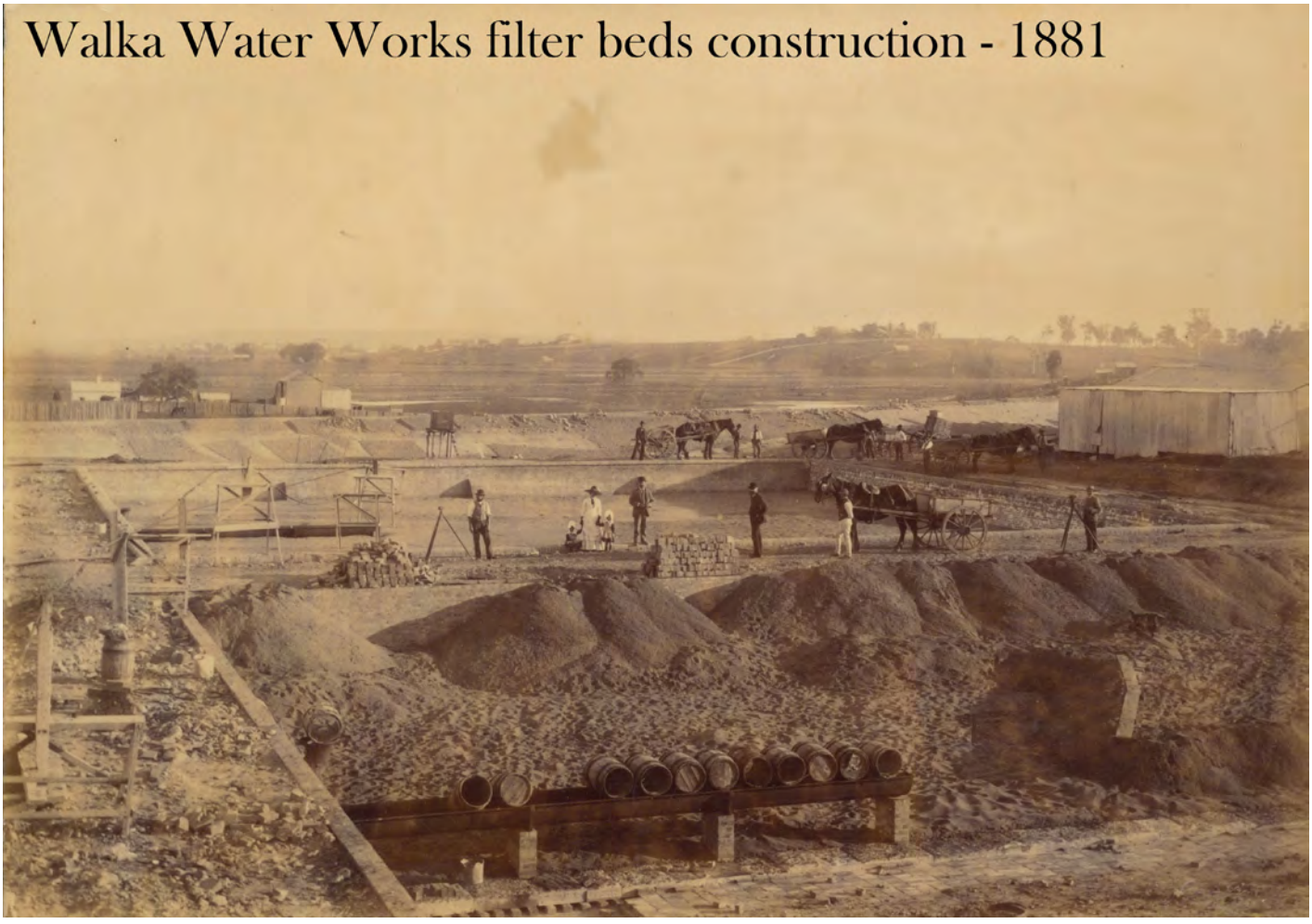
The James Watt & Co. beam engines (Hunter Water Corporation collection)

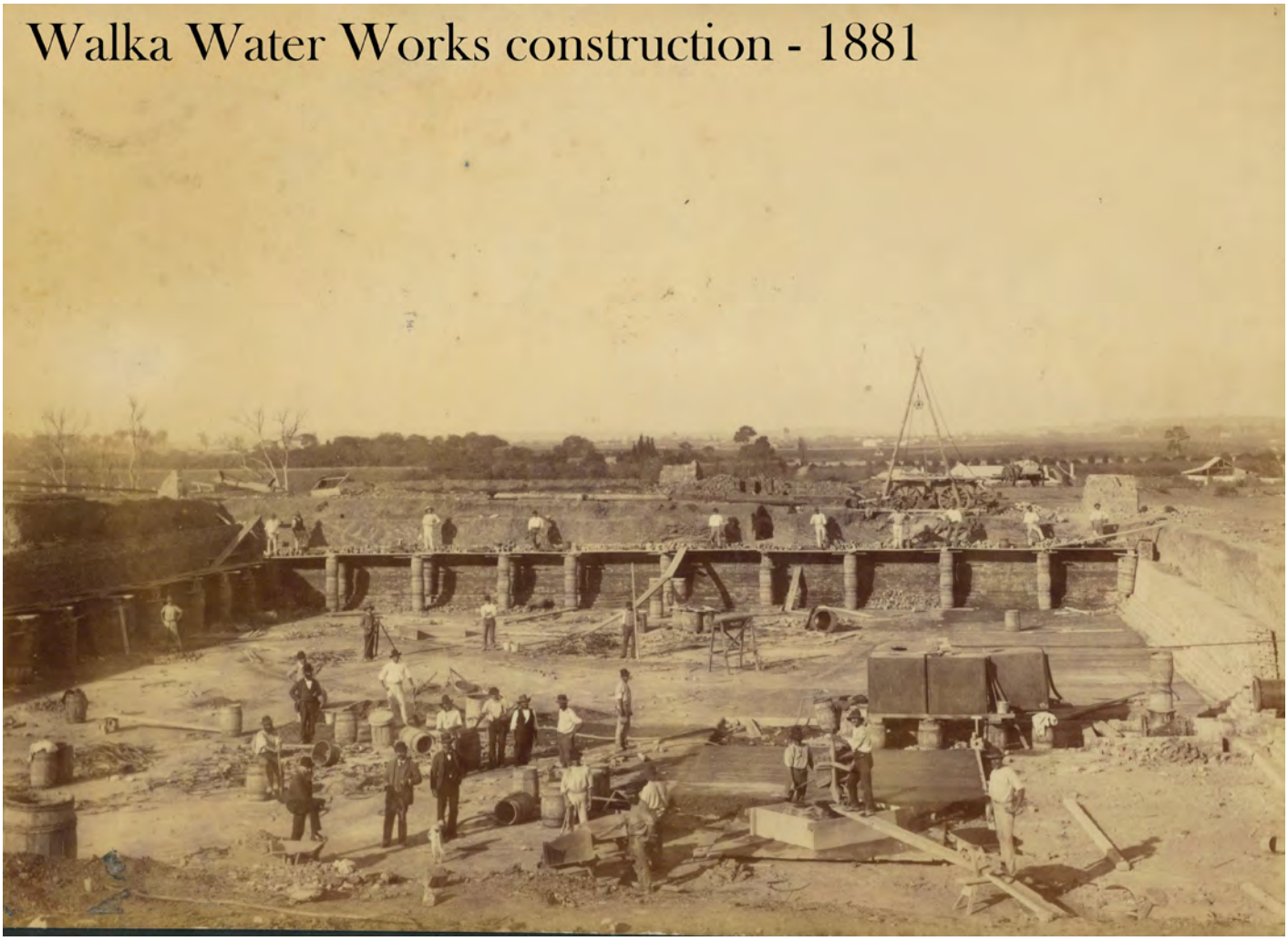


The boilers at Walka c. 1898 (Hunter Water Corporation collection)



Walka Water Works filter beds construction - 1881





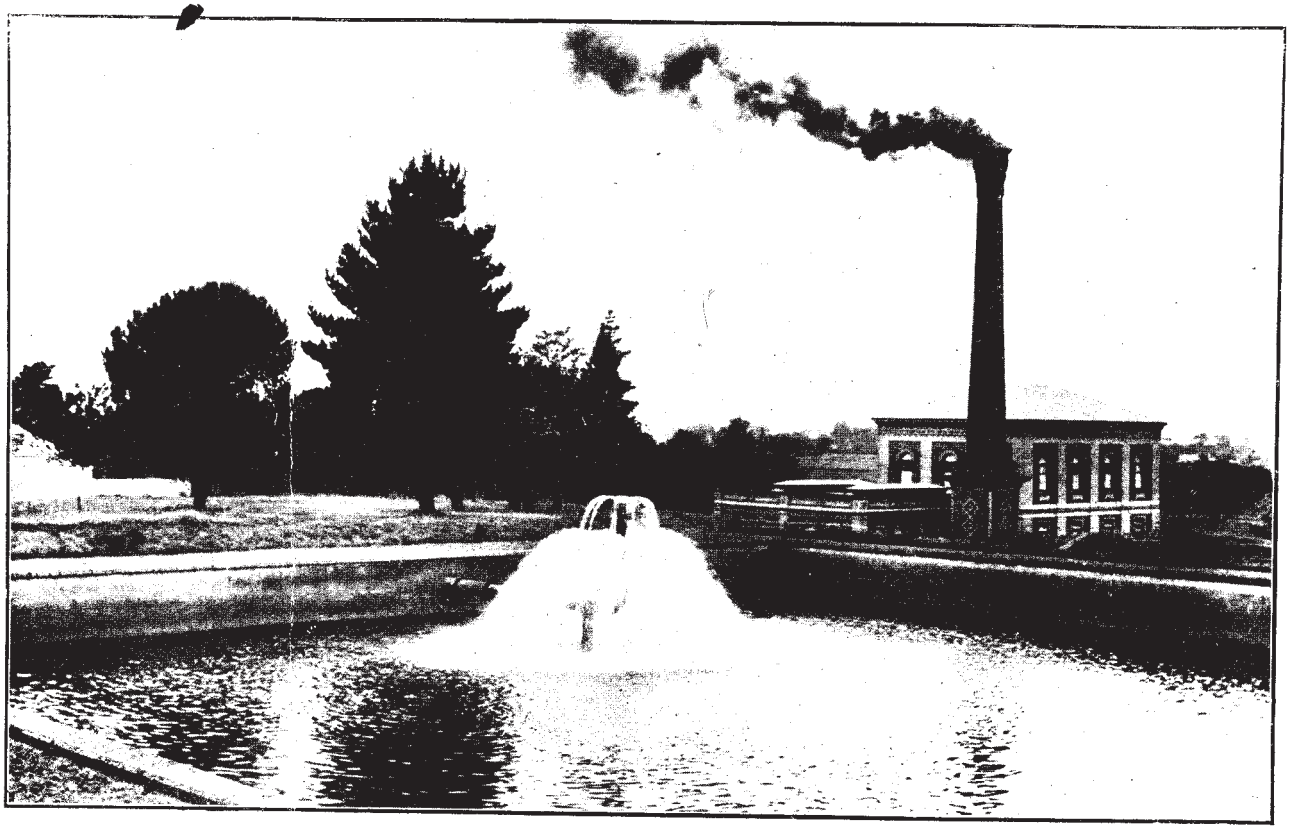
Imported cast iron pipes, some still found in service (Maitland City Council collection)

Pipe bridge under construction, possibly over Wallis Creek (Hunter Water Corporation collection)

The Obelisk reservoir under construction ((Hunter Water Corporation collection))

THE WATERWORKS.

The water supply of the district is under the control of the Hunter District Water and Sewerage Board, constituted in 1892. Water is pumped from the Hunter River to reservoirs at the pumping station at Walka, a few miles out of West Maitland. The drainage area above the intake is over 7000 miles in area, and the annual rainfall is 25 inches, and the number of persons settled on the drainage area is approximately 50,000. The scheme was originally designed by the late Wm. Clarke, M.Inst.C.E., in 1877, and the construction of the works was commenced in 1879. Extensions and improvements have since been



effected. The water is pumped firstly in to large reservoirs, and secondly into two summit reservoirs at Buttai and Rutherford, and the water then gravitates to Newcastle and Maitland districts. Buttai reservoir has a capacity of 1,500,000 gallons. Fifteen district reservoirs are supplied from Buttai, 11 by gravitation and four by re-pumping. The length of mains under the Board's control is 463 miles 1051 yards. During drought times there is an insufficient supply of water for all practical purposes, and to meet this difficulty and the increasing supplies which will be needed in the future, an immense dam is being constructed at Chichester in the Dungog district, and this is expected to be completed in the course of a few years, when the augmented supply will be amply sufficient for the next 50 years or more.

Early 20th century newpaper cutting, origin not known (Hunter Water Corporation collection)

1776 FORM A. 25

Institution of Civil Engineers,

25, GREAT GEORGE STREET, WESTMINSTER, S.W.

Christian and Surnames and Address in full. William Clark of Calcutta being upwards of 25 years of age, and being desirous of admission into the Institution of Civil Engineers, I recommend him, from PERSONAL KNOWLEDGE, as a person in every respect worthy of that distinction.*

Qualifications of the Candidate, in accordance with the Bye Laws (SEE THE NEXT PAGE).

Because after being educated at Kings College London, he was for 4 years pupil & assisted under Mr. J. C. Birkinshaw (M. Inst. C.E.) then for 3 years was Surveyor to Local Board of Health Hull when he designed and commenced the execution of the drainage works there next was for 1½ yr on the East Indian Railway as Resident Engineer in charge of works & has since been for 7 yrs engaged under the Municipality of Calcutta for 1 yr as Secretary & for remainder as Executive Engineer in which he has designed & carried out the drainage of that City as far as yet completed

On the above grounds I beg leave to propose him to the Council as a proper person to be admitted into the Institution.

Signature of the Proposer Geo. Turnbull M. Inst. C. E.

We, the undersigned, concur in the above recommendation, being convinced that Wm Clark is in every respect a proper person to be admitted into the Institution.

Signatures of the Seconders, who must be, at least THREE MEMBERS *and* TWO ASSOCIATES *of the Institution,* FROM PERSONAL KNOWLEDGE.

FROM PERSONAL KNOWLEDGE.	FROM PERSONAL KNOWLEDGE.
Jno. Grant	Henry Wyden
Alex. W. Makinson	
W Purdon	
S. C. Homersham.	
H. L. Castle	

To be filled up by the Council.

The Council, having considered the above recommendation, present Wm Clark to be balloted for as Member of the Institution of Civil Engineers.

Passed by the Council 1st time January 19. 1864

2nd time January 26. 1864

Read to the Meeting January 26. 1864

Balloted for February 2. 1864 J. M. Gillear *Chairman.*

* The Bye-Laws require the qualifications of the individual as set forth in Clauses 2, 3, 4, 5, Section II., to be distinctly stated, so that the Members and Associates of the Institution may be enabled to judge of the qualifications of the Candidate.

INSTRUCTIONS FOR FILLING UP THE FORM ARE ANNEXED.

Clark, William (1821-1880) (DNB00)

From Wikisource

CLARK, WILLIAM (1821–1880), civil engineer and inventor, was born at Colchester, 17 March 1821. He went to King's College, London, in 1842, and was elected an associate of the college in 1845. Soon afterwards he became a pupil of, and subsequently an assistant to, J. Birkinshaw, M. Inst. C.E., under whom he was employed for three years on the works of the York and North Midland railway system. In 1850 he was connected with Sir Goldsworthy Gurney in the warming and ventilation of the houses of parliament. In 1851 he entered into partnership with A. W. Makinson, M. Inst. C.E., the firm devoting special attention to the warming and ventilating of public buildings. He shortly afterwards obtained the appointment of surveyor to the local board of health of Kingston-upon-Hull, and devised a complete system of drainage for that town. In 1854 he entered the service of the East Indian Railway Company, and, after acting for a year as resident engineer on a portion of the East India railway, became the secretary and subsequently the engineer to the municipality of Calcutta. Clark devoted himself with zeal to his work, and very soon proposed a complete scheme for the drainage of the city, only imperfectly carried out owing to the expense. He also devised a system of waterworks, comprising three large pumping stations, with their filter beds and settling tanks. He returned to England in 1874, when he entered into partnership with W. F. Batho, M. Inst. C.E., and in the same year received the appointment of consulting engineer to the Oudh and Rohilkund Railway Company. In December 1874 he visited Madras, where he remained four months planning a system of drainage for that city. He was selected by the colonial office in 1876, in concert with the government of New South Wales, to advise and report upon the water supply and drainage of Sydney. During a residence of two years in the Australian colonies he prepared schemes of a like description for Port Adelaide, Newcastle, Bathurst, Goulburn, Orange, Maitland, and Brisbane, and afterwards for Wellington and Christchurch in New Zealand. Among Clark's inventions was his tied brick arch, of which examples exist in Calcutta and in other places in India; and he was joint patentee with Batho of the well-known steam road roller. Among his schemes was a proposal for reclaiming the salt-water lakes in the neighbourhood of Calcutta. He was elected a member of the Institution of Civil Engineers 2 Feb. 1864, and a member of the Institution of Mechanical Engineers in 1867. He died from an affection of the liver, at Surbiton, 22 Jan. 1880. He was the writer of ‘The Drainage of Calcutta,’ 1871.

[Minutes of Proceedings of Inst. of Civil Engineers, lxiii. 308–10 (1881); Proceedings of Inst. of Mechanical Engineers, 1881, p. 3.]

G. C. B.

APPENDIX D

Heritage listings for elements of the scheme

Walka Water Works

Item details

Name of item:	Walka Water Works
Type of item:	Complex / Group
Group/ Collection:	Utilities - Water
Category:	Other - Utilities - Water
Location:	Lat: -32.7126308625 Long: 151.5488847410
Primary address:	Oakhampton Road, East Maitland, NSW 2323
Parish:	Maitland
County:	Northumberland
Local govt. area:	Maitland

Property description

Lot/ Volume Code	Lot/ Volume Number	Section Number	Plan/ Folio Code	Plan/ Folio Number
LOT	445		DP	722263

All addresses

Street Address	Suburb/ town	LGA	Parish	County	Type
Oakhampton Road	East Maitland	Maitland	Maitland	Northumberland	Primary Address
55 Scobies Lane	Oakhampton Heights	Maitland	Maitland	Northumberland	Alternate Address
Oakhampton Road	West Maitland	Maitland	Maitland	Northumberland	Duplicate Address

Owner/ s

Organisation Name	Owner Category	Date Ownership Updated
Walka Water Works Trust	Private	29 Mar 99

Statement of significance:

Walka Waterworks is one of the largest and most intact 19th century industrial complexes in the Hunter Valley. The surviving water treatment features at the site constitute the most comprehensive set in NSW and clearly illustrate water filtration and reticulation processes and the major developments which occurred during the late 19th and early 20th century. The pump house, chimney and boiler house are elegant finely executed polychrome brick structures in a traditional configuration which are located within an attractive landscape. The entire complex, including reservoir and tanks, is an important cultural landmark.(Godden & Assoc 1986: 30)

Date significance updated: 01 Oct 97

Note: There are incomplete details for a number of items listed in NSW. The Heritage Branch intends to develop or upgrade statements of significance and other information

for these items as resources become available.

Description

Designer/ Maker:	Public Works Department
Builder/ Maker:	Public Works Department
Construction years:	1882-1886
Physical description:	The group of buildings known as the Walka Waterworks are located within the site boundaries north west of the dam. The buildings and structures of the complex are generally constructed of load bearing brickwork, with trussed roof structures to the main engine houses, and roofed with corrugated iron. MAIN PUMP HOUSE - 2 storey polychrome brick structure with walls up to 1 metre thick. It contains a basement approximately 10 metres deep. Six cast iron columns built to support the first floor remain but all other original features have been replaced or obscured by a raised floor, office partitians and a stairway constructed in the 1950s. The first floor retains sufficient fixtures to demonstrate its previous operations. Original sections of flooring remain as do cast iron cross beams, shoes, joists, decorative grills, timber floor joists and the pilaster which carried the overhaul beam crane. A large sandstone block is located within the wall above and below each pair of joists. The original colour scheme is still visible. BOILER ROOM - attached to the northern end of the main pump house. The roof is double hipped and clad in corrugated iron and has been subject to modifications. Surviving features include the steam header access hole in the southern wall, column capitals, the flue, the access door to the engine room and an unusual configuration of windows beneath relieving arches in the brickwork. CHIMNEY - polychrome brick standing 36 metres tall. Square base translating through an octagonal section to become a tapering cylinder, terminating in finely corbelled brickwork. A flue leads to the chimney from the centre of the western wall of the boiler room. EASTERN EXTENSION TO PUMPHOUSE - 1893 - office - original 9 pane windows replaced by 6 pane windows. An extremely unsympathetic entrance and set of stairs have been inserted in the southern wall. Internal amenities installed during the 1950s by the Electricity Commission and plumbing fittings remain. WESTERN PUMP HOUSE - 1913 - the building abuts the main pumphouse, its form and detail successfully reflecting the original building. The pump house required the bricking in of openings to the main pump house and removal or relocation of the original window joinery. The existing 9 pane windows on the western side of the building are probably the only remaining original windows of the complex. The internal brickwork is rendered and painted but along its eastern side it retains the profile of the exterior of the main pump house. The roof trusses of riveted steel are exposed. The southern wall is constructed of timber and corrugated iron to enable further expansion. WORKSHOP - A small single storey building north of, and seperate from, the original boiler room. Four cast iron chutes penetrate the northern wall. This wall is a retaining wall built against an embankment which defines the northern boundary of the pumping station complex. This wall is angled with a butressed base and weepholes. Concrete steps adjacent to the east lead to the road above. The building contains fire bricks for use in the Electricity Commission boilers. BOILER ROOM ADDITION - a lean to roof and western wall of corrugated iron over a timber frame erected between the workshop and boiler room in 1913. SETTLING TANK - large rectangular tank (220' x 115' x 10') located north west of the pump house complex. The walls are sandstock brick covered with cement render. The floor is concrete. The tank has not been

	filled and remains largely intact. Several of its associated artefacts and components, including a vertical iron inlet pipe on the eastern side , an outlet and overflow pipes on the southern side and height guage and ladder remain. A steep, centrally located set of concrete steps lead south down an embankment to the filter beds. FILTER BEDS - Seven beds were constructed in 3 stages. Beds 1-4 were laid out in a grid fashion around a north/south pipe. All were built of sandstone blocks. Beds 2 and 4 have been damamged by the erection of concrete bases for cooling towers associated with the c1950s power station. Beds 1 and 3 have been uncovered and probably remain substantially intact. Beds 5 and 6 are of different construction, having been added in 1908. They feature off-form concrete walls with pre-cast concrete cappings. Bed 7 was built in 1913 in a similar design to the 1908 beds and is in reasonable condition. The filtration layers of sand, gravel and brick may remain in silt within beds 1,3,5,6 & 7 CLEARWATER TANK - of brick construction and located below the filter beds. The brick piers of the rim show evidence of the roof line but iron supports for the roof have been removed. The western side features gate piers with brick caps. The intake, outlet and overflow pipes associated with this tank remain in situ. RESERVOIR - The reservoir edges follow the natural land contours on the northern and western sides and are bounded by an earthern embankment made from material excavated during the construction of the tanks, filter beds and pumping station on the southern and eastern ends. Its internal face is lined with Ravensfield sandstone blocks. A brick byewash(4m x 2m) is located at the southern west extremity of the reservoir. It has an arched, butressed brick face covered with concrete render. The byewash contains a large valve which could be opened to lower or drain the water in the resevoir. A circular brick structure with an iron trap door is centrally located on the reservoir's north bank and a small valve house is present about 30m fron the eastern wall. A discharge cooling tunnel runs parallel with the northern bank. CHIEF ENGINEER'S RESIDENCE - 9 room brick cottage. Substantial footings and rubble, a tennis court and an approach road flanked by introduced trees remain. SECOND ENGINEER'S COTTAGE - footing of the second engineers 6 room brick cottage remain. MISCELLANEOUS FEATURES - extensive system of concrete paved roads, paths and kerbing installed by the Electricity Commission in the 1950s. Remnants of the planting scheme installed at the site by the Electricity Commission. Sparse scatter of plantings from the original period of operation, including an avenue of trees near the Chief Engineer's residence. A substantial railway formation, including cuttings and embankments, runs from the site of the power station along the northern edge of the reservoir and connects to the North Coast railway main line at the western end of the site. Some sections of the railway track remain in situ. A vehicle track follows the railway line. A cast iron pipe network and a steel pipe network remain. The steel steps and concrete footings for the fuel air pump house can be seen at the edge of the rail track below filter bed 7. (Godden & Assoc. 1986: 7-29)
Physical condition and/ or Archaeological potential:	Archaeological potential low-medium - may be some evidence of aboriginal occupation. Filled in areas may contain industrial archaeological remains. The structures on the site are generally in a sound and well preserved condition. (Tresev (a) 1986: 33)
Modifications and dates:	1892 - a 3rd pump attached to No.3 beam engine 1893 - eastern extension to main pump house 1908 - filter beds 5 & 6 built

1913 - western pumphouse built
-boiler room addition betwen workshop and boiler room
- pump shed built (now gone - n.d)
- filter bed 7 built
-Babcock and Wilcox boilers, steam economiser, feed pumps and
accessories and a vertical triple expansion 3 plunger pump engine
added
1949 - concrete floor installed in western pumphouse after water pumping machinery removed.
1950s - Electricity Commission installs amenities in eastern pump house extension and makes alterations to pump house
1975 - Second Engineer's cottage demolished
(Godden & Assoc 1986: 7-29) (Turner 1986: 15)

Current use:Recreation area
Former use: Water pumping station

History

Historical notes:

The Newcastle Borough Council established a Water Committee to try to improve water supply to residents of the inner city area in February 1875 after a very dry period. In 1876 the local member G.A.Lloyd, M.L.A., raised the matter of government help to finance the construction of a water supply for Newcastle. To the surprise of many, other parliamentarians supported the motion. In 1877 Sir Henry Parkes sent noted British hydraulic engineer William Clark to advise on possible water sources for the Lower Hunter towns. Clark had been brought to NSW to advise on Sydney's water supply and drainage problems. Clark's report recommended Walka as the site for a water works which would supply 37 000 people at the estimated cost of 170 000 pounds.

The citizens of Newcastle were pleased with the scheme and its cost and quickly approved the plan. They sent a deputation to Parliament on 5 December 1877 with strong encouragement from John Robertson, the Colonial Secretary. Construction of a water supply was imminent. However, a new government came to power before the end of the year. Another deputation was sent to Sydney, but James Farnell and his government preferred to give preference to the construction of a second water supply in Sydney

At the end of 1878 a new government took over and a third deputation was sent to Parliament. By May 1879 the necessary surveys and cost estimates had been sufficiently advanced to allow the ordering of machinery and iron pipes but the government refused to bow to pressure from the Hunter region to sanction full expenditure. In 1881 the first steps were taken and the Newcaastle and Buttai reservoirs were constructed. Land was resumed for the Walka works in June that year.

The Public Works Department called for tenders to construct the Walka reservoir and associated works in December 1882 and contracts were signed in April 1883. At least four contracting firms were involved, Messrs. T.Smith and M.Burley, George Blunt, James Russell and James Watt and Company. Smith and Burley were responsible for the tunnel which drew water from the river to the pumping station. George Blunt built the reservoir, filter beds and settling and clear water tanks and James Watt and Company of Birmingham supplied and erected the three pumping stations installed at Walka in 1886. James Russell completed the construction of the engine and boiler house although there is dispute as to whether Russell won the contract originally. It is argued that M.Parkhill, a relatively unknown contractor, was given the contract in 1885 but became insolvent, leaving the opportunity for Russell to take over.

The waterworks served as the sole water supply of the Lower Hunter towns from 1887 until 1929 when it was superceded by the Tarro Pumping Station. Industrial development and an increasing population in the period resulted in a growth in demand for water and the need for considerable development and modification at the site. In 1892 the pumps were improved and a third pump was attached to the No.3 beam engine. This was also the year that the Hunter District Water Supply and Sewerage Board took over the works. In 1896-7 a second pipe was constructed between the Hunter River and the waterworks. In 1900 Newcastle was consuming double the water it had consumed in 1892.

The implementation of the waterworks scheme for drinking and washing made possible the provision of sewerage systems to the towns. This improved the health of the community by reducing the likelihood of disease and improving the cleanliness of the population and their urban environment.

Severe droughts in 1902 and 1905-6 produced supply problems and demonstrated that the Hunter River was no longer an adequate water source for the region. In 1908 the number of filter beds was increased from four to six and by 1910 it had become necessary at times to operate three beam pumping engines simultaneously. In 1913 more equipment was installed and a furrther four rapid water filters were installed in 1916. The completion of the Chichester Dam in 1924 saw the waterworks downgraded to a standby function in 1925. The waterworks were shut down as an economy measure in 1931. The engines and pumps were started only so that the plant could be tested or overhauled.
(Turner 1986: 1-16)

In 1945 the works finally closed. Between 1951 and 1978 a portion of the site was leased to the Electricity Commission of NSW for siting of a prefacbricated power plant as a temporary solution to overcome post war deficiencies in generating equipment. The powerplant was decommissioned in 1976 and dismantled in 1978.
(Tresev Pty Ltd (a) 1986: 8-9)

Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
3. Economy-Developing local, regional and national economies	Technology-Activities and processes associated with the knowledge or use of mechanical arts and applied sciences	(none)-

Assessment of significance

SHR Criteria a) [Historical significance]	Establishment of the complex was a major political and engineering achievement, finally providing a permanent supply of clean water to Newcastle residents. Changes and developments at the complex document the growth of the demand for water. An expectation of further expansion is evidenced in the temporary nature of the southern wall of the pump house west annex. The construction, expansion and demise of the waterworks were vital stages in the establishment and growth of the Hunter Valley Waterboard. The ultimate demise of the site as a water treatment plant and its subsequent development (and demise) as a power station documents significant periods of growth and change in the community. William Clark, a prominent hydraulics engineer and a number of other noteworthy individuals were closely associated with the complexes design, construction and expansion. (Godden & Assoc 1986: 30-31)
SHR Criteria c)	The entire site has been largely unmarred by the

[Aesthetic significance]	construction of any other unsympathetic developments. The reservoir catchment continues to provide a pleasant rural curtilage to the complex. The pumphouse, chimney and boiler house are finely executed polychrome brick structures which feature a degree of uniformity in materials, form and scale that is typical of many 19th century public buildings. The combination of elegant polychrome brick buildings, filter beds, tanks and reservoir with the nearby topography creates an element of considerable cultural interest and beauty within an already attractive landscape. (Godden & Assoc 1986: 31)
SHR Criteria d) [Social significance]	The complex is an outstanding resource for the interpretation of the importance of 19th century industrial processes. For many years it has been a cultural landmark to the people of Maitland and the Hunter Valley. (Godden & Assoc 1986: 32) The site is the centrepiece of the most important advance in public health in the history of the Hunter Valley, improving health and cleanliness of the population and their urban environment. Furthermore, without a water supply many secondary industries which provided employment in the Newcastle area could not have been established. (Turner 1986: 16)
SHR Criteria e) [Research potential]	The complex is the only complete set of 19th century water filtration equipment extant in NSW and illustrates water treatment filtration processes. The configuration and substantial remains of all major components of the complex, including evident remains of machinery locations and ancillary structures, such as pipes, enable the processes carried out to be clearly understood. The largely intact set of Victorian structures typify the building associations of a 19th century technology. The evolution of the complex over time provides evidence of the development of steam technology from beam engines to reciprocating engines. (Godden & Assoc 1986: 31-32)
SHR Criteria g) [Representativeness]	The intact nature of the site makes it an excellent representation of water filtering and reticulation processes of the period.
Assessment criteria:	Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Procedures / Exemptions

Section of act	Description	Title	Comments	Action date
57(2)	Exemption to allow work	Heritage Act	Record converted from HIS events Order Under Section 57(2) to exempt the following activities from Section 57(1): (1) The maintenance of any building or item on the site where maintenance means the continuous protective care of existing material; and (2) Garden maintenance including cultivation, weed control, the repair and maintenance of existing fences, gates and garden walls and pruning and tree surgery but not including extensive lopping. (3) Eradication of noxious plants and animals, (Weed species in natural areas to be removed either by manual means or treated by spot application of herbicide to avoid detrimental effects on native vegetation.	Oct 3 1986
57(2)	Exemption to allow	Standard Exemptions	SCHEDULE OF STANDARD EXEMPTIONS	Sep 5 2008

	work		HERITAGE ACT 1977 Notice of Order Under Section 57 (2) of the Heritage Act 1977 I, the Minister for Planning, pursuant to subsection 57(2) of the Heritage Act 1977, on the recommendation of the Heritage Council of New South Wales, do by this Order: 1. revoke the Schedule of Exemptions to subsection 57(1) of the Heritage Act made under subsection 57(2) and published in the Government Gazette on 22 February 2008; and 2. grant standard exemptions from subsection 57(1) of the Heritage Act 1977, described in the Schedule attached. FRANK SARTOR Minister for Planning Sydney, 11 July 2008 To view the schedule click on the Standard Exemptions for Works Requiring Heritage Council Approval link below.	

Standard exemptions for works requiring Heritage Council approval

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Heritage Act - State Heritage Register		00466	02 Apr 99	27	1546
Heritage Act - Permanent Conservation Order - former		00466	03 Oct 86	156	4877
Local Environmental Plan			03 Sep 93		
Register of the National Estate			21 Mar 78		

References, internet links & images

Type	Author	Year	Title	Internet Links
Written	Don Godden & Associates	1986	Industrial Archaeology in Tresev Pty Ltd 'Specialist Report for Walka Waterworks Conservation plan	
Written	J.W.Turner	1986	Historical & Heritage Significance in Tresev Pty Ltd Specialist Report for Walka waterworks Conservation Plan	
Written	Tresev Pty Ltd (a)	1986	Conservation Plan. Walka Waterworks	
Management Plan	Tresev Pty Ltd (b)	1986	Specialist Reports for Walka waterworks Conservation Plan	
Tourism	Walka	2007	Walka Water Works	

	Water Works Organisation		Campground	View detail

Note: internet links may be to web pages, documents or images.




(Click on thumbnail for full size image and image details)

Data source

The information for this entry comes from the following source:

Name:	Heritage Office
Database number:	5045638
File number:	S90/05699 & HC 32608

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Walka Water Works (including boiler house and western annexes)

Item details

Name of item:	Walka Water Works (including boiler house and western
Other name/s:	Pumping Station
Type of item:	Complex / Group
Group/Collection:	Utilities - Water
Category:	Water Pump House/Pumping Station
Primary address:	55 Scobies Lane, Oakhampton Heights, NSW 2323
Parish:	Maitland
County:	Northumberland
Local govt. area:	Maitland

All addresses

Street Address	Suburb/town	LGA	Parish	County	Type
55 Scobies Lane	Oakhampton Heights	Maitland	Maitland	Northumberland	Primary Address

Statement of significance:

Walka Waterworks is one of the largest and most intact 19th century industrial complexes in the Hunter Valley. The surviving water treatment features at the site constitute the most comprehensive set in NSW and clearly illustrate water filtration and reticulation processes and the major developments which occurred during the late 19th and early 20th century. The pump house, chimney and boiler house are elegant finely executed polychrome brick structures in a traditional configuration which are located within an attractive landscape. The entire complex, including reservoir and tanks, is an important cultural landmark.(Godden & Assoc 1986: 30)

Date significance updated: 01 Oct 97

Note: There are incomplete details for a number of items listed in NSW. The Heritage Branch intends to develop or upgrade statements of significance and other information for these items as resources become available.

Description

Designer/Maker:	Public Works Department
Builder/Maker:	Public Works Department
Construction years:	1882-1886
Physical description:	The group of buildings known as the Walka Waterworks are located within the site boundaries north west of the dam. The buildings and structures of the complex are generally constructed of load bearing brickwork, with trussed roof structures to the main engine houses, and roofed with corrugated iron. MAIN PUMP HOUSE - 2 storey polychrome brick structure with walls up to 1 metre thick. It contains a

basement approximately 10 metres deep. Six cast iron columns built to support the first floor remain but all other original features have been replaced or obscured by a raised floor, office partitians and a stairway constructed in the 1950s. The first floor retains sufficient fixtures to demonstrate its previous operations. Original sections of flooring remain as do cast iron cross beams, shoes, joists, decorative grills, timber floor joists and the pilaster which carried the overhaul beam crane. A large sandstone block is located within the wall above and below each pair of joists. The original colour scheme is still visible.
BOILER ROOM - attached to the northern end of the main pump house. The roof is double hipped and clad in corrugated iron and has been subject to modifications. Surviving features include the steam header access hole in the southern wall, column capitals, the flue, the access door to the engine room and an unusual configuration of windows beneath relieving arches in the brickwork.
CHIMNEY - polychrome brick standing 36 metres tall. Square base translating through an octagonal section to become a tapering cylinder, terminating in finely corbelled brickwork. A flue leads to the chimney from the centre of the western wall of the boiler room.
EASTERN EXTENSION TO PUMPHOUSE - 1893 - office - original 9 pane windows replaced by 6 pane windows. An extremely unsympathetic entrance and set of stairs have been inserted in the southern wall. Internal amenities installed during the 1950s by the Electricity Commission and plumbing fittings remain.
WESTERN PUMP HOUSE - 1913 - the building abuts the main pumphouse, its form and detail successfully reflecting the original building. The pump house required the bricking in of openings to the main pump house and removal or relocation of the original window joinery. The existing 9 pane windows on the western side of the building are probably the only remaining original windows of the complex. The internal brickwork is rendered and painted but along its eastern side it retains the profile of the exterior of the main pump house. The roof trusses of riveted steel are exposed. The southern wall is constructed of timber and corrugated iron to enable further expansion.
WORKSHOP - A small single storey building north of, and seperate from, the original boiler room. Four cast iron chutes penetrate the northern wall. This wall is a retaining wall built against an embankment which defines the northern boundary of the pumping station complex. This wall is angled with a butressed base and weepholes. Concrete steps adjacent to the east lead to the road above. The building contains fire bricks for use in the Electricity Commission boilers.
BOILER ROOM ADDITION - a lean to roof and western wall of corrugated iron over a timber frame erected between the workshop and boiler room in 1913.
SETTLING TANK - large rectangular tank (220' x 115' x 10') located north west of the pump house complex. The walls are sandstock brick covered with cement render. The floor is concrete. The tank has not been filled and remains largely intact. Several of its associated artefacts and components, including a vertical iron inlet pipe on the eastern side , an outlet and overflow pipes on the southern side and height guage and ladder remain. A steep, centrally located set of concrete steps lead south down an embankment to the filter beds.
FILTER BEDS - Seven beds were constructed in 3 stages. Beds 1-4 were laid out in a grid fashion around a north/south pipe. All were built of sandstone blocks. Beds 2 and 4 have been damamged by the erection of concrete bases for cooling towers associated with the c1950s power station. Beds 1 and 3 have been uncovered and probably remain substantially intact.
Beds 5 and 6 are of different construction, having been added in 1908. They feature off-form concrete walls with pre-cast concrete cappings. Bed 7 was built in 1913 in a similar design to the 1908 beds and

	is in reasonable condition. The filtration layers of sand, gravel and brick may remain in silt within beds 1,3,5,6 & 7 CLEARWATER TANK - of brick construction and located below the filter beds. The brick piers of the rim show evidence of the roof line but iron supports for the roof have been removed. The western side features gate piers with brick caps. The intake, outlet and overflow pipes associated with this tank remain in situ. RESERVOIR - The reservoir edges follow the natural land contours on the northern and western sides and are bounded by an earthern embankment made from material excavated during the construction of the tanks, filter beds and pumping station on the southern and eastern ends. Its internal face is lined with Ravensfield sandstone blocks. A brick byewash(4m x 2m) is located at the southern west extremity of the reservoir. It has an arched, butressed brick face covered with concrete render. The byewash contains a large valve which could be opened to lower or drain the water in the resevoir. A circular brick structure with an iron trap door is centrally located on the reservoir's north bank and a small valve house is present about 30m fron the eastern wall. A discharge cooling tunnel runs parallel with the northern bank. CHIEF ENGINEER'S RESIDENCE - 9 room brick cottage. Substantial footings and rubble, a tennis court and an approach road flanked by introduced trees remain. SECOND ENGINEER'S COTTAGE - footing of the second engineers 6 room brick cottage remain. MISCELLANEOUS FEATURES - extensive system of concrete paved roads, paths and kerbing installed by the Electricity Commission in the 1950s. Remnants of the planting scheme installed at the site by the Electricity Commission. Sparse scatter of plantings from the original period of operation, including an avenue of trees near the Chief Engineer's residence. A substantial railway formation, including cuttings and embankments, runs from the site of the power station along the northern edge of the reservoir and connects to the North Coast railway main line at the western end of the site. Some sections of the railway track remain in situ. A vehicle track follows the railway line. A cast iron pipe network and a steel pipe network remain. The steel steps and concrete footings for the fuel air pump house can be seen at the edge of the rail track below filter bed 7. (Godden & Assoc. 1986: 7-29)
Physical condition and/ or Archaeological potential:	Archaeological potential low-medium - may be some evidence of aboriginal occupation. Filled in areas may contain industrial archaeological remains. The structures on the site are generally in a sound and well preserved condition. (Tresev (a) 1986: 33)
Modifications and dates:	1892 - a 3rd pump attached to No.3 beam engine 1893 - eastern extension to main pump house 1908 - filter beds 5 & 6 built 1913 - western pumphouse built -boiler room addition betwen workshop and boiler room - pump shed built (now gone - n.d) - filter bed 7 built -Babcock and Wilcox boilers, steam economiser, feed pumps and accessories and a vertical triple expansion 3 plunger pump engine added 1949 - concrete floor installed in western pumphouse after water pumping machinery removed. 1950s - Electricity Commission installs amenities in eastern pump house extension and makes alterations to pump house 1975 - Second Engineer's cottage demolished (Godden & Assoc 1986: 7-29) (Turner 1986: 15)

History

Historical notes:

The Newcastle Borough Council established a Water Committee to try to improve water supply to residents of the inner city area in February 1875 after a very dry period. In 1876 the local member G.A.Lloyd, M.L.A., raised the matter of government help to finance the construction of a water supply for Newcastle. To the surprise of many, other parliamentarians supported the motion. In 1877 Sir Henry Parkes sent noted British hydraulic engineer William Clark to advise on possible water sources for the Lower Hunter towns. Clark had been brought to NSW to advise on Sydney's water supply and drainage problems. Clark's report recommended Walka as the site for a water works which would supply 37 000 people at the estimated cost of 170 000 pounds.

The citizens of Newcastle were pleased with the scheme and its cost and quickly approved the plan. They sent a deputation to Parliament on 5 December 1877 with strong encouragement from John Robertson, the Colonial Secretary. Construction of a water supply was imminent. However, a new government came to power before the end of the year. Another deputation was sent to Sydney, but James Farnell and his government preferred to give preference to the construction of a second water supply in Sydney

At the end of 1878 a new government took over and a third deputation was sent to Parliament. By May 1879 the necessary surveys and cost estimates had been sufficiently advanced to allow the ordering of machinery and iron pipes but the government refused to bow to pressure from the Hunter region to sanction full expenditure. In 1881 the first steps were taken and the Newcaastle and Buttai reservoirs were constructed. Land was resumed for the Walka works in June that year.

The Public Works Department called for tenders to construct the Walka reservoir and associated works in December 1882 and contracts were signed in April 1883. At least four contracting firms were involved, Messrs. T.Smith and M.Burley, George Blunt, James Russell and James Watt and Company. Smith and Burley were responsible for the tunnel which drew water from the river to the pumping station. George Blunt built the reservoir, filter beds and settling and clear water tanks and James Watt and Company of Birmingham supplied and erected the three pumping stations installed at Walka in 1886. James Russell completed the construction of the engine and boiler house although there is dispute as to whether Russell won the contract originally. It is argued that M.Parkhill, a relatively unknown contractor, was given the contract in 1885 but became insolvent, leaving the opportunity for Russell to take over.

The waterworks served as the sole water supply of the Lower Hunter towns from 1887 until 1929 when it was superceded by the Tarro Pumping Station. Industrial development and an increasing population in the period resulted in a growth in demand for water and the need for considerable development and modification at the site. In 1892 the pumps were improved and a third pump was attached to the No.3 beam engine. This was also the year that the Hunter District Water Supply and Sewerage Board took over the works. In 1896-7 a second pipe was constructed between the Hunter River and the waterworks. In 1900 Newcastle was consuming double the water it had consumed in 1892.

The implementation of the waterworks scheme for drinking and washing made possible the provision of sewerage systems to the towns. This improved the health of the community by reducing the likelihood of disease and improving the cleanliness of the population and their urban environment.

Severe droughts in 1902 and 1905-6 produced supply problems and demonstrated that the Hunter River was no longer an adequate water source for the region. In 1908 the number of filter beds was increased from four to six and by 1910 it had become necessary at times to operate three beam pumping engines simultaneously. In 1913 more equipment was installed and a furrther four rapid water filters were installed in 1916. The completion of the Chichester Dam in 1924 saw the waterworks downgraded to a standby function in 1925. The waterworks were shut down as an economy measure in 1931. The engines and pumps were started only so that the plant could be tested or overhauled.
(Turner 1986: 1-16)

In 1945 the works finally closed. Between 1951 and 1978 a portion of the site was leased to the Electricity Commission of NSW for siting of a prefacbricated power plant as a temporary solution to overcome post war deficiencies in generating equipment. The powerplant was decommissioned in 1976 and dismantled in 1978.
(Tresev Pty Ltd (a) 1986: 8-9)

Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
3. Economy-Developing local, regional and national economies	Technology-Activities and processes associated with the knowledge or use of mechanical arts and applied sciences	(none)-

Assessment of significance

SHR Criteria a) [Historical significance]	Establishment of the complex was a major political and engineering achievement, finally providing a permanent supply of clean water to Newcastle residents. Changes and developments at the complex document the growth of the demand for water. An expectation of further expansion is evidenced in the temporary nature of the southern wall of the pump house west annex. The construction, expansion and demise of the waterworks were vital stages in the establishment and growth of the Hunter Valley Waterboard. The ultimate demise of the site as a water treatment plant and its subsequent development (and demise) as a power station documents significant periods of growth and change in the community. William Clark, a prominent hydraulics engineer and a number of other noteworthy individuals were closely associated with the complexes design, construction and expansion. (Godden & Assoc 1986: 30-31)
SHR Criteria c) [Aesthetic significance]	The entire site has been largely unmarred by the construction of any other unsympathetic developments. The reservoir catchment continues to provide a pleasant rural curtilage to the complex. The pumphouse, chimney and boiler house are finely executed polychrome brick structures which feature a degree of uniformity in materials, form and scale that is typical of many 19th century public buildings. The combination of elegant polychrome brick buildings, filter beds, tanks and reservoir with the nearby topography creates an element of considerable cultural interest and beauty within an already attractive landscape. (Godden & Assoc 1986: 31)
SHR Criteria d) [Social significance]	The complex is an outstanding resource for the interpretation of the importance of 19th century industrial processes. For many years it has been a cultural landmark to the people of Maitland and the Hunter Valley. (Godden & Assoc 1986: 32) The site is the centrepiece of the most important advance in public health in the history of the Hunter Valley, improving health and cleanliness of the population and their urban environment. Furthermore,

	without a water supply many secondary industries which provided employment in the Newcastle area could not have been established. (Turner 1986: 16)
SHR Criteria e) [Research potential]	The complex is the only complete set of 19th century water filtration equipment extant in NSW and illustrates water treatment filtration processes. The configuration and substantial remains of all major components of the complex, including evident remains of machinery locations and ancillary structures, such as pipes, enable the processes carried out to be clearly understood. The largely intact set of Victorian structures typify the building associations of a 19th century technology. The evolution of the complex over time provides evidence of the development of steam technology from beam engines to reciprocating engines. (Godden & Assoc 1986: 31-32)
SHR Criteria g) [Representativeness]	The intact nature of the site makes it an excellent representation of water filtering and reticulation processes of the period.
Assessment criteria:	Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Regional Environmental Plan			03 Nov 89		
Local Environmental Plan		I222	16 Dec 11		
Local Environmental Plan			03 Sep 93		

References, internet links & images

Type	Author	Year	Title	Internet Links
Written	Don Godden & Associates	1986	Industrial Archaeology in Tresev Pty Ltd 'Specialist Report for Walka Waterworks Conservation plan	
Written	J.W.Turner	1986	Historical & Heritage Significance in Tresev Pty Ltd Specialist Report for Walka waterworks Conservation Plan	
Written	Tresev Pty Ltd (a)	1986	Conservation Plan. Walka Waterworks	
Written	Tresev Pty Ltd (b)	1986	Specialist Reports for Walka waterworks Conservation Plan	

Note: internet links may be to web pages, documents or images.

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Data source

The information for this entry comes from the following source:

Name:	Local Government
Database number:	2000187
File number:	HC 32608 & S90/05699

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Buttai No. 1 Reservoir

Item details

Name of item:	Buttai No. 1 Reservoir
Type of item:	Built
Group/ Collection:	Utilities - Water
Category:	Water Supply Reservoir/ Dam
Location:	Lat: -32:47:34.54 Long: 151:33:40.755
Primary address:	Lot 1 Buttai Rd, Four Mile Creek, NSW 2323
Local govt. area:	Cessnock

Boundary:

Curtilage includes the No 1 Reservoir structure only and does not inc
2 Reservoir or surrounding bushland.

All addresses

Street Address	Suburb/ town	LGA	Parish	County	Type
Lot 1 Buttai Rd	Four Mile Creek	Cessnock			Primary Address

Owner/ s

Organisation Name	Owner Category	Date Ownership Updated
Hunter Water Corporation Limited	State Government	

Statement of significance:

Buttai Reservoir No 1 is the oldest operating reservoir within the Hunter Water system. Constructed as an intermediate water storage for the original water supply scheme which pumped water from the Hunter River into Newcastle, it continues to function within the modern water supply system. The vaulted brick arch construction is uncommon and includes a finely detailed sandstone entry. The reservoir is unusual in that the tops of the arches are exposed, allowing the structure of the reservoir to be fully viewed.

Date significance updated: 30 Jul 10

Note: There are incomplete details for a number of items listed in NSW. The Heritage Branch intends to develop or upgrade statements of significance and other information for these items as resources become available.

Description

Designer/ Maker:	Public Works Department/Newcastle Council
Builder/ Maker:	Public Works Department/Newcastle Council
Construction years:	1880-1881
Physical description:	Abrick rectangular inground reservoir situated in remnant bushland, at the top of a hill. The reservoir

has an arched brick roof, consisting of 6 arches, with a bitumen capping. The brick walls of the reservoir have a sandstone capping. Original steel vents are located intermittently along the brick walls, with some cracking to bricks in places.

There is a decorative sandstone portico entry point to reservoir, with "1882" engraved on the pediment. The portico's sandstone is somewhat degraded. A green painted wooden door is located in a the portico, in addition to a circular window at the rear, the glass of which has been replaced with steel mesh.

Internally, the brick arches are supported on brick columns.

Physical condition and/or Archaeological potential:	The portico's sandstone is somewhat degraded. The reservoir is in good structural condition in general. Date condition updated:27 Aug 10
Further information:	A later addition, Buttai Reservoir No. 2, forms an L shape around the Buttai No. 1 Reservoir and is made of concrete. The two structures are connected internally. To the north of Buttai No. 1 Reservoir is the site of the old turncock's cottage, which was burnt down.

Current use:Reservoir
Former use: Reservoir

History

Historical notes: Construction on the Buttai Reservoir commenced in 1880, after the passage of the Country Towns Water Supply Act by NSW Parliament. Completed in 1881, it, along with the other water infrastructure erected in the region by Newcastle Council and the Public Works Department, was transferred to the Hunter District Water Supply and Sewerage Board at the time of its formation in 1892.

Constructed of brickwork set in Portland cement with solid concrete foundations on a sandstone bed, Buttai Reservoir originally measured approximately 120 feet by 95 feet, was 15 feet deep, and had a capacity of 1 000 000 gallons of water.

Originally, Buttai Reservoir received water from the Walka Waterworks, which extracted, filtered and treated water from the Hunter River, before transferring it into the two summit reservoirs (the other being East Maitland Reservoir). As the Hunter River water delivered from Walka Waterworks needed to be sheltered from light to prevent recontamination after treatment, the reservoirs were covered. Buttai Reservoir was roofed with brick arches covered with earth and grass, which also helped maintain the water at a low temperature. Constructed on top of a range about 5 ½ miles from the pumps at Walka Waterworks, Buttai Reservoir was supplied through a 15 inch rising main. The high elevation of the reservoir, which saw a direct lift of about 270 feet, combined with the friction losses through the 9 000 yards of mains, necessitated special gears on the engines that forced the water from the waterworks to the reservoir.

Buttai Reservoir supplied water, via gravitation, to the six district reservoirs at Minmi, Hamilton, Wallsend, Newcastle, Lambton and Obelisk Hill, providing reticulation to the City of Newcastle, Carrington, Wickham, Hamilton, Waratah, Merewether, Adamstown, New Lambton, Lambton, Wallsend, Plattsburg, and Minmi. From Buttai, the 15-inch cast-iron gravitation main extended for about 17 miles across hills, ravines, and swamps as far as the reservoir in Tyrrell Street. The first water from Buttai arrived at the Newcastle Reservoir on December 31, 1885.

The old water line was tapped at various places along the route. A 15 cm diameter branch pipe, just over 3 kilometres long, supplied Minmi Reservoir. Wallsend and Plattsburg received water through an 8-inch branch pipe, and at the junction of Tudor and Beaumont Street, a 38 cm branch pipe supplied the reservoir at The Glebe. Lambton Reservoir was located adjacent to the main delivery pipe.

In 1898 the pipeline from Walka Waterworks to Buttai was duplicated. This new rising main was constructed of 20 inch riveted steel pipes and was completed and vested in the Board on 10th May 1898. In 1903-04 a 20 inch trunk main was laid from Buttai Reservoir to Heddon Greta following approval of a scheme to extend the water mains to the townships of the coalfields to the south of Maitland. New outlet works were constructed at Buttai Reservoir to feed the old 15-inch and the new 20-inch gravitation mains which supplied the Newcastle District in 1908-09. These works comprised a valve-house with a Venturi water meter for controlling and measuring the flow of water. The work was completed in late 1908, and the permanent connection of the new 20-inch main was made in February 1909.

As part of the scheme prepared by the Constructing Authority for the Public Works Department in the mid 1910s, which would lead to the construction of Chichester Dam, it was proposed that a steel gravitation main of 8 million gallons capacity per day be constructed from the dam to connect with the existing pipe-line to Buttai Reservoir, as well as an additional gravitation main from Buttai Reservoir to Waratah Reservoir.

In the late 1920s, due to the increases in water reticulation thanks to the construction of Chichester Dam, Buttai Reservoir was extended (known as Buttai No. 2 Reservoir) to hold a further 3 514 00 gallons of water to obviate shortages of water supply to Cessnock. This extension was completed in 1928, and made available for the summer of 1928-29. The reservoirs have been connected internally.

In 1947-48 a scheme to amplify the water distribution was investigated, which included the augmentation of supply from Buttai Reservoir to Neath Pumping Station. In 1956 a 24-inch pipeline was laid for 2 ½ miles between Stoney Pinch and Buttai Reservoirs to improve supply. In 1960-61 a 20-inch cement-lined cast iron water main was completed between Buttai Reservoir and Heddon Greta, replacing an 18-inch wood stave main.

It was decided in the late 1990s to roof the remaining open reservoirs under the control of the Hunter Water Corporation. By June 1999 construction on the roof of Buttai Reservoir No. 2 had commenced

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Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
4. Settlement-Building settlements, towns and cities	Utilities-Activities associated with the provision of services, especially on a communal basis	Water-

Assessment of significance

SHR Criteria a) [Historical significance]	Buttain Resrevoir No 1 was a major component of the Walka Scheme, which pumped water from the Hunter River into central Newcastle. The Reservoir served as an interim storage for the Scheme and helped maintain pressure within the system. It is the oldest operating reservoir within the Hunter Water system.

SHR Criteria b) [Associative significance]	Not significant against this criterion - no known significant associations.
SHR Criteria c) [Aesthetic significance]	The Buttai Reservoir No 1 has a finely detailed entrance portico contructed in sandstone, which demonstartes the civic pride taken in the public infrastructure of the day, even for remote and inaccessible items such as this site.
SHR Criteria d) [Social significance]	Limited significance against this criterion - while bringing water into Newcastle would have been of major social import in the late 19th century, this type of public service is commonplace and expected in modern Australia.
SHR Criteria e) [Research potential]	Limioted significane against this criteria - thew archaeological remains of the former turncock's house are located near the entrance to the reservoir, however the building was only burnt down recently. The exposed upper surface of the brick arched roof is unusual and allows a good understanding of the consturction of the reservoir.
SHR Criteria f) [Rarity]	The item is rare as the oldest operating reservoir within the system.
SHR Criteria g) [Representativeness]	The item is typical of underground brick arched reservoirs.
Integrity/ Intactness:	Relatively intact, with some modifications to the entrance portico. An internal connection has been established between Reservoir No 1 and No 2.
Assessment criteria:	Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Recommended management:

- This item is important to the heritage of NSW and must be conserved. - A Conservation Management Plan should be prepared for this item to facilitate appropriate long-term management. - Original details must be maintained including doors, windows and original signage. - New materials should be sympathetic to the nature and character of the original building. - In the event of major proposed changes prepare a Statement of Heritage Impact and undertake an archival recording. - Assess proposed changes against the Standard Exemptions for Works Requiring Heritage Council Approval and, if necessary, seek approval under the Heritage Act. - Wherever possible, changes should be restricted to the interior of the building and be designed to minimise impact to significant fabric. - Routine maintenance of existing fabric is essential. Note - SHR curtilage includes the Buttai No. 1 Reservoir structure (including entry portico) only. Buttai No. 2 Reservoir is excluded from the SHR listing.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Heritage Act - s.170 NSW State agency heritage register					
Heritage study					

Study details

Title	Year	Number	Author	Inspected by	Guidelines used
Hunter Water	2010		Futurepast		Yes

Conservation and Heritage Register Study			Heritage Consulting Pty Ltd		

References, internet links & images

Type	Author	Year	Title	Internet Links
Written	Clem Lloyd, Patrick Troy and Shelley Schreiner	1992	For the Public Health. The Hunter District Water Board 1892-1992	
Written	Department of Public Works		Annual Reports, 1888 to 1892 and 1893-94 to 1960-61	
Written	Glennie Jones	1967	The Movement for Newcastle's First Water Supply 1875-1885, Newcastle History Monographs No. 2	
Written	Hunter District Water Board		Annual Reports, 1938-39 to 1987-88	
Written	Hunter District Water Supply and Sewerage Board		Annual Reports, 1897-98 to 1937-38	
Written	Hunter Water Board		Annual Reports, 1988-89 to 1990-91	
Written	Hunter Water Corporation		Annual Reports, 1991-92 to 2008-09	
Written	John W Armstrong	1967	Pipelines and People. The History of the Hunter District Water Board Newcastle, New South Wales	
Written	Mal Hindley	1983	'From Weirs, Dams and Sand', in Shaping the Hunter	

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The information for this entry comes from the following source:

Name: State Government

Database number: 3630004

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Newcastle Reservoirs Site

Item details

Name of item:	Newcastle Reservoirs Site
Type of item:	Built
Group/ Collection:	Utilities - Water
Category:	Water Supply Reservoir/ Dam
Location:	Lat: -32:55:53.97 Long: 151:46:35.426
Primary address:	Lot 346 Tyrrell St, The Hill, NSW 2300
Local govt. area:	Newcastle

Boundary:

The curtilage includes the entire site, including Reservoirs 1 and 2, th boundary walls and gates.

All addresses

Street Address	Suburb/ town	LGA	Parish	County	Type
Lot 346 Tyrrell St	The Hill	Newcastle			Primary Address

Owner/ s

Organisation Name	Owner Category	Date Ownership Updated
Hunter Water Corporation Limited	State Government	

Statement of significance:

The Newcastle Reservoirs site is a complex containing examples of water supply infrastructure dating from the 1880s to the 1920s. This includes Newcastle Reservoir No. 1 (1888 - now decommissioned), Newcastle Reservoir No. 2 (1918 - in service), Newcastle Water Pumping station (decommissioned) and the Reservoir No. 2 Valve House (1918 - in service). The site provides a technical understanding of the progression of water supply technology from the original Hunter River pumping scheme through to the establishment of the Chichester Scheme, reflecting the growth and development of the Newcastle area generally. The complex is aesthetically well detailed, incorporating decorative sandstone and polychrome brickwork and is in a prominent location overlooking central Newcastle.

Date significance updated: 30 Aug 10

Note: There are incomplete details for a number of items listed in NSW. The Heritage Branch intends to develop or upgrade statements of significance and other information for these items as resources become available.

Description

Designer/ Maker:	Public Works Department
Builder/ Maker:	Public Works Department

Construction years:	1882-1918
Physical description:	The Newcastle Reservoirs site consists of two partially underground masonry reservoirs built into the hillside at Tyrell St in Newcastle, with associated valve houses. The site is enclosed to the west and south by battered brick retaining walls with stepped copings. Newcastle Reservoir No. 1 is contained by battered brick walls with stone quoins and grassed banks. The entry to the reservoir is a sandstone entry portal (similar to Buttai Reservoir No. 1) in the Tuscan Doric style. The reservoir structure is jack arch vaulted onto wrought iron beams supported on brick piers. The top of the reservoir is grassed. To the west of the reservoir is its associated valve house, a well-detailed polychrome brick structure with an insitu concrete roof with a decorative cornice. Both Reservoir No. 1 and the Valvehouse are disused. To the north is the later No. 2 Reservoir, a considerably larger concrete and brick structure which abuts Tyrrell Street. The exposed northern side of the reservoir is piered brickwork with concrete capping to the base of the inset panels and brick dentile course beneath the concrete cap. The roof of this reservoir is also flat and grassed. To the west of the No. 2 Reservoir is its associated valve house, a Marseille tiled hipped roofed brick structure with expressed corners and ornamental render details to the openings. The site is entered via sandstone steps leading to a wrought iron gate.
Physical condition and/ or Archaeological potential:	Reservoir No. 1 is decommissioned and was not inspected internally. There is some surface damage to the sandstone entry portico. The Reservoir No. 1 Valve House has a concrete deck roof with considerable spalling. Reservoir No. 2 is in service but was not inspected internally. The Reservoir No. 2 Valve House is in generally good condition with minor damage to timber elements. Graffiti and trespass-related damage are also issues on the site. Date condition updated:25 Aug 10

Current use:Water storage

History

Historical notes:	Work on the construction of the main city reservoir in Tyrrell Street (Newcastle No. 1 Reservoir) was begun in December 1880. When a scheme was prepared for the amplification of the water supply for the area in the mid 1910s, the Chichester Dam Scheme, provision was made for the extension of Newcastle No. 1 Reservoir. Construction of the Newcastle No. 2 Reservoir commenced on 14th May 1917, and was carried out by the Board under the day-labour system. Completed and placed into service on 30th June 1918, the reservoir was designed (together with the old reservoir adjoining) to provide the necessary storage capacity required for the low-level districts in the municipality of Newcastle. Built entirely in reinforced concrete, Newcastle No. 2 Reservoir contained a specially designed inlet valve that automatically governed the admission of water to the reservoir from the 15-inch Buttai-Newcastle trunk main. The provision of this valve also ensured that the delivery capacity of the trunk main was utilised to the maximum extent possible. The design for the reservoir and attachments was prepared by State Monier Department. In 1924-25 an alarm bell was installed at the reservoir to notify the caretaker of reservoir being full or empty.

Newcastle Reservoir Water Pumping Station: The water pumping station in Tyrrell St, Newcastle, was constructed in the late 1920s. Erected in order to increase the rate of supply of Chichester water to Newcastle Reservoir and thus do away with the liability of local shortages in this district, it was also able to draw water from Waratah Reservoir for the filling of Newcastle Reservoir, if required. Whilst the first successful test was completed on 8th January 1930, it was not found necessary to make use of the plant to any extent during the year 1929-30.

An electrically operated boosting plant, the Tyrrell Street Water Pumping Station consisted of two 9-inch centrifugal pumps, each driven by a 75 horsepower motor.

In 1948-49, water supply to the Tyrrell Street WPS was amplified through the laying of an additional 8-inch pipeline from the 12-inch pipeline in Parry Street, via Brooks Street, to the pumping station. In 1950-52 the pumping station was painted and renovated.

Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
4. Settlement-Building settlements, towns and cities	Utilities-Activities associated with the provision of services, especially on a communal basis	Water-

Assessment of significance

SHR Criteria a) [Historical significance]	The Newcastle Reservoirs site is associated with the origianl 1880s Walka Scheme, which pumped water from the Hunter River and the 1918 Chichester Scheme. These reservoirs were the main element of the water reticulation system for central Newcastle in the late 19th and early 20th centuries.
SHR Criteria b) [Associative significance]	These items do not meet this criterion at a State level.
SHR Criteria c) [Aesthetic significance]	The reservoirs are good examples of well-built masonry public infrastructure, with aesthetic detailing exhibiting a high dgeree of civic pride in the infrastructure. The reservoir site provides an evolution of technology in water supply over the early phases of the Newcastle water supply system.
SHR Criteria d) [Social significance]	This site has limited association with this criterion. While the provision of weater supply to central Newcastle would have been an event of major public import in the 19th century, such services are now commonplace.
SHR Criteria e) [Research potential]	These items do not meet this criterion at a State level.
SHR Criteria f) [Rarity]	These items, while sharing characteristics with other underground masonry reservoirs, are uniqe in this configuration within the Hunter Water system. Reservoir No 2 continues to serve as the major reservoir for this area of Newcastle.
SHR Criteria g) [Representativeness]	These items exhibit many of the standard characteristics of underground masonry reservoirs, but their configuration and relationship is specific to this site.
Integrity/ Intactness:	Quite intact, with minor issues (priamrily aesthetic) relating to fabric deterioration in some areas.
Assessment criteria:	Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Recommended management:

- This item is important to the heritage of NSW and must be conserved. - A Conservation Management Plan should be prepared for this item to facilitate appropriate long-term management. - Original details must be maintained including doors, windows and original signage. - New materials should be sympathetic to the nature and character of the original building. - In the event of major proposed changes prepare a Statement of Heritage Impact and undertake an archival recording. - Assess proposed changes against the Standard Exemptions for Works Requiring Heritage Council Approval and, if necessary, seek approval under the Heritage Act. - Wherever possible, changes should be restricted to the interior of the building and be designed to minimise impact to significant fabric. - Routine maintenance of existing fabric is essential.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Heritage Act - s.170 NSW State agency heritage register					
Heritage study					

Study details

Title	Year	Number	Author	Inspected by	Guidelines used
Hunter Water Conservation and Heritage Register Study	2010		Futurepast Heritage Consulting Pty Ltd		Yes

References, internet links & images

Type	Author	Year	Title	Internet Links
Written	Clem Lloyd, Patrick Troy and Shelley Schreiner	1992	For the Public Health. The Hunter District Water Board 1892-1992	
Written	Department of Public Works		Annual Reports, 1888 to 1892 and 1893-94 to 1960-61	
Written	Glennie Jones	1967	The Movement for Newcastle's First Water Supply 1875-1885, Newcastle History Monographs No. 2	
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Written	Hunter Water Board		Annual Reports, 1988-89 to 1990-91	
Written	Hunter Water Corporation		Annual Reports, 1991-92 to 2008-09	

Written	John W Armstrong	1967	Pipelines and People. The History of the Hunter District Water Board Newcastle, New South Wales	
Written	Mal Hindley	1983	'From Weirs, Dams and Sand', in Shaping the Hunter	

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Database number:	3630023

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